(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 1 264 570 A1

(12) EUROPEAN PATENT APPLICATION

published in accordance with Art. 158(3) EPC

(43) Date of publication:
11.12.2002 Bulletin 2002/50

(21) Application number: **01902816.6**

(22) Date of filing: **09.02.2001**

(51) Int Cl.[7]: **A47L 15/42**

(86) International application number:
PCT/JP01/00922

(87) International publication number:
WO 01/058335 (16.08.2001 Gazette 2001/33)

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE TR
Designated Extension States:
AL LT LV MK RO SI

(30) Priority: **14.02.2000 JP 2000034717**
10.03.2000 JP 2000066492
29.08.2000 JP 2000258648
19.01.2001 JP 2001011242
26.01.2001 JP 2001018147

(71) Applicant: **MATSUSHITA ELECTRIC INDUSTRIAL CO., LTD.**
Kadoma-shi, Osaka 571-8501 (JP)

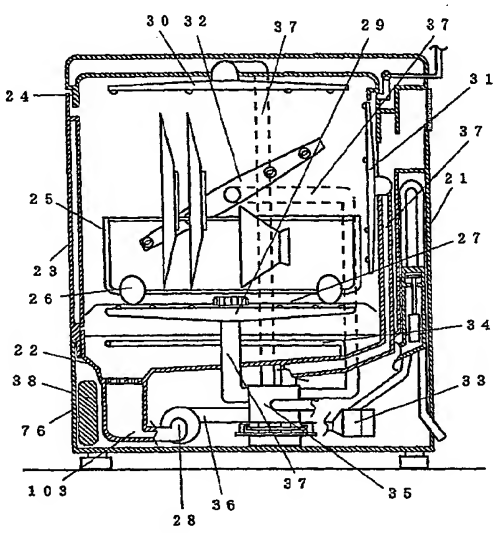
(72) Inventors:
- **INUI, Hiroaki**
  Toyonaka-shi, Osaka 561-0833 (JP)
- **OYAMA, Makoto**
  Kashiwara-shi, Osaka 582-0006 (JP)
- **YURA, Masaki**
  Ibaraki-shi, Osaka 567-0814 (JP)

(74) Representative: **Grünecker, Kinkeldey,**
Stockmair & Schwanhäusser Anwaltssozietät
Maximilianstrasse 58
80538 München (DE)

(54) WASHING MACHINE

(57) A washer includes a plurality of washing means for spraying washing water to an object to be washed from various directions of a washing tub and a washing water feeding means for feeding the washing water. The washing water is sequentially sprayed from respective washing means. Thus, the washing water can be sprayed to eating utensils from the various directions without increasing fed water, and a washing effect is improved. Speedy washing, energy saving, and water saving can be also achieved.

FIG. 1



EP 1 264 570 A1

Description

FIELD OF THE INVENTION

[0001] The present invention relates to a washer for household use or business use, and more particularly to a washer for washing by spraying washing water.

BACKGROUND OF THE INVENTION

[0002] A conventional dishwasher for washing eating utensils is described with reference to Fig. 43. The conventional dishwasher comprises body 1, washing tub 2, cover 3, exhaust port 4, rack 5, washing pump 8, washing nozzle 9, drain pump 10, controller 11, feed water hose 12, drain hose 13, heater 14, fan 15, and water level detecting means 20. Cover 3 is used for opening or closing an opening of the washing tub, and has exhaust port 4. Rack 5 accommodates the eating utensils. Washing pump 8 pressurizes washing water. Washing nozzle 9 is disposed in the lower part of washing tub 2. Drain pump 10 discharges, out of the dishwasher, washing water reserved in the washing tub. Controller 11 controls operations of washing pump 8 and drain pump 10. Heater 14 is disposed on the bottom of washing tub 2, and heats washing water, and heats air during drying. Fan 15 is used for drying. Rack 5 is supported via rollers 6 by a rail surface 7 formed on a side surface of washing tub 2. Washing nozzle 9 sprays the washing water pressurized by washing pump 8, from below to the eating utensils held by rack 5. Water level detecting means 20 detects a washing water level.

[0003] For washing eating utensils, the eating utensils to be washed are held in rack 5 of washing tub 2, a detergent is thrown in, and an operation is started. After the start of the operation, firstly a feed water process of supplying a predetermined amount of washing water to washing tub 2 is performed so as to stabilize a pressuring operation of the washing water by washing pump 8. Washing pump 8 has centrifugal blades (not shown) and an electric motor (not shown) for driving them. Approximately a predetermined interval (it is hereinafter called washing water level) is kept between intake port 16 of washing pump 8 and a washing water surface. Next, a primary washing process is performed. In the primary washing process, the washing water pressurized by washing pump 8 and heated by heater 14 is sprayed together with the detergent from spray port 17 of washing nozzle 9. The washing water is sprayed vertically, or obliquely and upwardly from spray port 17 of washing nozzle 9. Washing nozzle 9 is rotated substantially horizontally by reaction force of the spray. Collision force of the washing water sprayed from the rotating washing nozzle 9, the detergent, and heat are used for washing the eating utensil.

[0004] After the primary washing process is performed for a predetermined period, next, a draining process is performed. In the draining process, the washing water containing dirt removed from the eating utensils is discharged out of the dishwasher by drain pump 10. Subsequently, a feed water process of supplying new washing water, a rinsing process of spraying the washing water from washing nozzle 9to rinse the eating utensils soiled with the detergent or garbage (dirt attached to the eating utensils), and the draining process are sequentially repeated four times. These processes constitute a washing process.

[0005] After the washing process, a drying process is performed. In the drying process, fan 15 feeds air into washing tub 2 from the outside of the dishwasher. The air is fed from blast duct 18 into washing tub 2 through blast port 19, and simultaneously heater 14 is intermittently operated, thereby generating warm air. This warm air vaporizes water drops attached to the eating utensils to dry the eating utensils. In the drying process, the highly humid air in washing tub 2 is exhausted out of the dishwasher through exhaust port 4.

[0006] However, the washing nozzle of the conventional dishwasher sprays the washing water to various shapes of eating utensils used in a typical home only from a constant direction. Sufficient washing performance therefore cannot be obtained. When the washing water is not sprayed from the upper part of the washing tub during washing of an eating utensil such as a teacup or a soup bowl having a rim at its bottom, small garbage is apt to accumulate on the rim and water for rinse does not spread out sufficiently. Therefore, the rinsing is insufficient. For addressing these problems, a method of spraying washing water from various directions using a plurality of washing nozzles is proposed in Japanese Patent Application Non-examined Publication No. H5-305050. In this method, water to be reserved in a washing tub must be increased for spraying water at a time more than that in a prior art.

[0007] The increase of the fed water results in longer time to raise temperature of the washing water. This method therefore requires a longer operation time, more electricity, more usage of water, and a large washing pump. This causes various problems such as increase of the cost and increase of noise or vibration due to the spray of much washing water at a time.

[0008] Japanese Patent Application Non-examined Publication No. H5-176875 proposes a method for addressing these problems using a plurality of washing pumps. In this method, however, a plurality of washing pumps must be disposed for respective washing nozzles, and therefore volume ratio of a washing mechanism to an entire dishwasher increases. A space required for washing eating utensils cannot be sufficiently prepared, or size of the dishwasher body increases more than necessary. Japanese Patent Application Non-examined Publication No. H5-176875 has these problems.

[0009] Additionally, Japanese Patent Application Non-examined Publication No. H6-30853 discloses a washer having a structure in which a three-way valve is

heavily used for water division. However, when this washer is applied to a dishwasher that treats washing water containing garbage or foreign matters, operational reliability of a valve mechanism cannot be ensured. As a number of diversion channels increases, a number of three-way valves increases. The washer cannot deal with a complex discharge behavior of washing water of each washing nozzle, a specific abnormal sound occurs during a valve operation, and the cost increases. Japanese Patent Application Non-examined Publication No. H6-30853 has these problems.

[0010] As other examples of the washer spraying washing water, there are a component washer for removing grease or chips from a machined component by a machine tool or the like and a vegetable washer for removing foreign matters or chemicals attached to vegetables. However, these washers have the problems discussed above.

DISCLOSURE OF THE INVENTION

[0011] A washer of the present invention comprises the following elements:

a plurality of washing means for spraying washing water to an object to be washed from various directions;
a washing water feeding means for feeding the washing water to the washing means; and
a controller for controlling an operation of the washing water feeding means.

Each of the plurality of washing means has a spray port, and the spray port sprays the washing water. The washing water is sequentially supplied to respective washing means.

[0012] The washer, thanks to this structure, can spray the washing water to eating utensils without increasing a water amount, and can improve a washing effect. The washer can also wash the eating utensils speedily, and save energy and water.

[0013] The washer preferably further comprises a water dividing means disposed between the washing water feeding means and the plurality of washing means. The water dividing means includes a rotary water dividing unit having a discharge port and a divided water output unit having a plurality of divided water discharge ports. Each washing means communicates with each divided water discharge port. The divided water output unit is disposed in the rotary water dividing unit so that the discharge port sequentially faces to and communicates with divided water discharge ports when the rotary water dividing unit rotates. The washing water fed from the washing water feeding means is discharged from the discharge port of the rotary water dividing unit, sequentially fed to each divided water discharge port, guided to each washing means, and sprayed from each washing means.

[0014] This structure further improves the washing effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a sectional view of a dishwasher in accordance with exemplary embodiment 1 of the present invention.
Fig. 2 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher in accordance with exemplary embodiment 1.
Fig. 3 is an exploded perspective view showing a water dividing structure of the dishwasher in accordance with exemplary embodiment 1.
Fig. 4 is a fragmentary sectional view showing a driving structure of another water dividing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 5 is a perspective view of still another washing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 6 is a perspective view of still another washing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 7 is a perspective view of still another washing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 8 is a perspective view of still another washing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 9 is a perspective view of still another washing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 10 is a perspective view of still another washing means of the dishwasher in accordance with exemplary embodiment 1.
Fig. 11 is a sectional view of a dishwasher in accordance with exemplary embodiment 2 and exemplary embodiment 18 of the present invention.
Fig. 12 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher in accordance with exemplary embodiment 18.
Fig. 13 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in a dishwasher in accordance with exemplary embodiment 3 of the present invention.
Fig. 14 is an exploded perspective view of a water dividing structure of the dishwasher in accordance with exemplary embodiment 3.
Fig. 15 is a sectional view of a dishwasher in accordance with exemplary embodiment 4 of the present invention.
Fig. 16 is a fragmentary sectional view showing a structure of a water dividing means and flow of

washing water in the dishwasher in accordance with exemplary embodiment 4.

Fig. 17 is an exploded perspective view of a water dividing structure of the water dividing means of the dishwasher in accordance with exemplary embodiment 4.

Fig. 18 is a sectional view of a dishwasher in accordance with exemplary embodiment 5 of the present invention.

Fig. 19 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher in accordance with exemplary embodiment 5.

Fig. 20 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in a dishwasher in accordance with exemplary embodiment 6 of the present invention.

Fig. 21 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 7 of the present invention.

Fig. 22 is a fragmentary sectional view showing a spray state of the changeover unit of the dishwasher in accordance with exemplary embodiment 7.

Fig. 23 is a graph showing water spray force of water sprayed, during one rotation of a water dividing means, from each washing means of the dishwasher in accordance with exemplary embodiment 7 of the present invention.

Fig. 24 is a fragmentary sectional view of a double-stack rack of a dishwasher in accordance with exemplary embodiment 8 of the present invention.

Fig. 25 is a fragmentary perspective view of a water dividing means of the dishwasher in accordance with exemplary embodiment 8.

Fig. 26 is an exploded perspective view of a water dividing means of a dishwasher in accordance with exemplary embodiment 9 of the present invention.

Fig. 27 is a perspective view showing spray of washing water in the dishwasher in accordance with exemplary embodiment 9.

Fig. 28 is a sectional view showing a rack state in the dishwasher in accordance with exemplary embodiment 9.

Fig. 29 is an exploded perspective view of a water dividing structure of a dishwasher in accordance with exemplary embodiment 10 of the present invention.

Fig. 30 is a fragmentary sectional view of a changeover unit of the dishwasher in accordance with exemplary embodiment 10.

Fig. 31 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 11 of the present invention.

Fig. 32 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 12 of the present invention.

Fig. 33 is a fragmentary perspective view of a changeover unit of a dishwasher in accordance with exemplary embodiment 13 of the present invention.

Fig. 34 is a sectional view of a passage varying means of the dishwasher in accordance with exemplary embodiment 13.

Fig. 35 is a perspective view of a changeover unit of a dishwasher in accordance with exemplary embodiment 14 of the present invention.

Fig. 36 is a fragmentary sectional view of the changeover unit of the dishwasher in accordance with exemplary embodiment 14.

Fig. 37 is a graph showing variation in discharge pressure of each washing nozzle and a washing pump per cycle of a rotary water dividing unit of the dishwasher in accordance with exemplary embodiment 14.

Fig. 38 is a sectional view of a water dividing structure of a dishwasher in accordance with exemplary embodiment 15 of the present invention.

Fig. 39 is an exploded perspective view of the water dividing structure of the dishwasher in accordance with exemplary embodiment 15.

Fig. 40 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 16 of the present invention.

Fig. 41 is a graph showing variation in discharge pressure of each washing nozzle and a washing pump per cycle of a rotary water dividing unit of the dishwasher in accordance with exemplary embodiment 16.

Fig. 42 is a sectional view of a dishwasher in accordance with exemplary embodiment 17 of the present invention.

Fig. 43 is a block diagram of a conventional dishwasher.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] A washer in accordance with an exemplary embodiment of the present invention comprises a plurality of washing means and a washing water feeding means. Each of the plurality of washing means has a spray port. Washing water is sprayed to objects to be washed through spray ports from various directions. The washing water is sequentially fed to the plurality of washing means.

[0017] This structure allows reduction of washing time, consumed energy, and consumed water. Energy and water can be thus saved.

[0018] A washer in accordance with another exemplary embodiment of the present invention comprises a rack for accommodating objects to be washed such as eating utensils, a washing tub for holding the rack, a cover for opening or closing an opening in the washing tub, a plurality of washing means having a spray port for spraying washing water to the objects to be washed from various directions, a washing water feeding means for pressurizing the washing water, a controlling means

for controlling the washing water feeding means or the like, and a water dividing means. The water dividing means, which includes a driving means, is disposed in a passage for feeding/discharging the water (it is hereinafter called feeding/discharging passage) for connecting the washing water feeding means with the washing means. The washing water is sequentially fed to the plurality of washing means.

[0019] This structure allows spray of washing water to any object to be washed from a plurality of directions without increasing fed water. High efficient washing for allowing speedy washing can be thus realized, and a number of rinsings is decreased. Consumed energy and also consumed water are therefore reduced. Especially, when the washer washes eating utensils, the eating utensils can be arbitrarily set into the rack and thus a setting position and a setting method can be freely set, in addition to the production of the advantageousness discussed above. As a result, setting ability is further improved.

[0020] The washer of this exemplary embodiment preferably has the following structure.

[0021] The water dividing means comprises an aqueduct, a discharge port, a rotary water dividing unit, and a divided water output unit. The aqueduct guides the washing water pressurized by the washing water feeding means. The discharge port is disposed in any surface of a substantially cylinder, and discharges the washing water guided by the aqueduct. The rotary water dividing unit is rotated by the driving means as a driving source. The divided water output unit has a plurality of feeding/discharging passages, covers the rotary water dividing unit, and sequentially feeds the washing water to the washing means. In this structure, one movable component is employed for the plurality of feeding/discharging passages, and thus changeover between channels is allowed. As a result, a simple and reliable water dividing apparatus can be realized.

[0022] A plurality of discharge ports are formed in the rotary water dividing unit, and the washing water is supplied to the plurality of washing means. This structure increases washing water sprayed to the objects to be washed per unit time, and improves washing performance in a short time.

[0023] The driving means is structured so as to set an arbitrary rotation speed. This structure allows washing water amount sprayed from each washing means to vary in response to quantity and quality of dirt adhered to eating utensils or the like. As a result, washing time is optimized to improve the washing performance, the washing time is reduced, or energy is saved.

[0024] The driving means preferably includes a rotation angle detecting means for detecting a rotation angle. The washing water can therefore fed to a specific feeding/discharging passage for any time, and washing energy corresponding to degree of dirt of the objects to be washed can be applied.

[0025] The driving means is preferably structured so as to forwardly and reversely rotate. When the washing water is sprayed between specific washing means, the washing water does not need to be fed to the washing means other than a washing means contributing to washing. As a result, efficient washing is allowed.

[0026] The plurality of discharge ports formed in the rotary water dividing unit are disposed at respective positions where rotation tracks of them are not identical. The rotary water dividing unit can be made compact, and its rotating ' radius can be made small. The feeding/discharging passage is easily assigned to each washing means. A structure where the feeding/discharging passage is not bent is allowed, so that pressure loss in the feeding/discharging passage can be reduced. Therefore, discharge force of the washing means is increased to improve washing performance, or the washing water feeding means is downsized to downsize a mechanism unit.

[0027] At least one of the plurality of divided water discharge ports is preferably disposed in a surface substantially vertical to a rotating shaft of the rotary water dividing unit. Thanks to this divided water discharge port, washing water guided by the aqueduct has low channel resistance and is fed directly to the washing means. Therefore, the discharge force of the washing means is increased to improve washing performance, or washing water feeding means is downsized to further downsize the mechanism unit. Reaction force of the spray of the rotary water dividing unit applied to a driving shaft of the driving means can be also reduced, so that a mounting structure of the driving means becomes simple.

[0028] The rotary water dividing unit is preferably disposed substantially horizontally. The rotary water dividing unit for dividing water to the plurality of washing means is structured so as to have a short radius and be long in the longitudinal direction. An optimum length of the feeding/discharging passage can be set for each washing means disposed at a different position in a washing tub. Installing ability of the water dividing apparatus itself onto the lower part of the washing tub can be further improved. A water dividing structure having the feeding/discharging passage of which a number of bendings is smaller can be formed, so that passage pressure loss in the water dividing means can be reduced.

[0029] The driving shaft of the driving means is preferably disposed in the substantially same direction as flow direction of washing water discharged from the washing water feeding means. The driving means is disposed on the opposite side of the discharge port of the washing water feeding means with respect to the rotary water dividing unit. The driving means can be thus disposed between the discharge port of the washing water feeding means and the aqueduct. Therefore, pressure loss in the channel decreases, and a structure between the driving shaft of the driving means and the rotating shaft of the rotary aqueduct is simplified. A seal dis-

posed between the driving shaft and the driving source can be formed in a simple structure, so that undesired increase in the cost can be prevented.

[0030] The divided water discharge port is preferably disposed at a position higher than the discharge port of the washing water feeding means. Air in the washing water feeding means is thus prevented from remaining in water dividing means during water feeding, and the air flows into the washing tub through the washing means. This prevents remaining of the air in a casing of the washing water feeding means and thus entrainment of the air into the washing water. As a result, a trouble that the entrainment disturbs the start of a washing pump is prevented, and washing failure is prevented to secure stable washing performance.

[0031] Any surface of the rotary water dividing unit having the discharge port is preferably conical or curved. Difference between an entering angle and a going-out angle of washing water flow from the rotary water dividing unit to the divided water discharge port can be therefore reduced. The passage pressure loss between the rotary water dividing unit and the divided water discharge port can be reduced.

[0032] The changeover unit disposed in the water dividing means preferably has a structure in which an opening area of at least one first divided water discharge port and a passage cross section area of a first feeding/discharging passage communicating with the first divided water discharge port are larger than an opening area of the discharge port. This structure can reduce the pressure loss of washing water flowing through the changeover unit. High washing and discharge force can be therefore obtained without using an oversize washing water feeding means.

[0033] The first divided water discharge port preferably has a rectangular or substantially elliptical shape circumferentially longer than that of the discharge port. This washing means communicating with the first divided water discharge port can discharge washing water for a longer time than that of the other washing means. The discharge time of the washing means can be changed without changing rotation speed of the driving source for driving the rotary water dividing unit. Therefore, sufficient washing water can be sprayed to eating utensils from which dirt is hardly removed in an inexpensive structure. Washing time of eating utensils can be also reduced.

[0034] The first feeding/discharging passage preferably comprises two following passages: a passage of which cross section area changes from the cross section area of the first divided water discharge port to a passage cross section area of a second feeding/discharging passage; and a passage having a cross section area substantially equal to a passage cross section area of a second divided water discharge port. Thanks to this structure, circulated washing water does not increase even when the passages enlarge. Therefore, feed water is reduced to shorten warming time, washing time can be reduced, and energy can be saved.

[0035] Circumferential direction length of the discharge port is preferably substantially equal to or longer than the circular arc length between the adjacent divided water discharge ports. The discharge port thus surely partially matches to any feeding/discharging passage. Excessive pressure increase can be prevented in a passage from the washing water feeding means to the washing means. Therefore, excessive load onto a connection part and a seal part in the washing passage is prevented from extremely reducing endurance reliability.

[0036] The circumferential direction length of the discharge port is preferably substantially equal to or longer than the sum of a circular arc length of any divided water discharge port and the circular arc length between the adjacent divided water discharge ports. Amount of circulated washing water discharged from the washing water feeding means can thus be always kept constant. Therefore, the pressure variation of a connection part and a seal part in the feeding/discharging passage is prevented, and the reduction of the endurance reliability is prevented. Washing energy discharged individually from each washing means varies periodically, but washing energy discharged from the whole washing means is always constant. Therefore, constant washing energy can be applied to the eating utensils to allow efficient washing of the eating utensils.

[0037] The changeover unit disposed in the water dividing means preferably has a rotary water dividing unit including a plurality of discharge ports. All discharge ports can be prevented from simultaneously communicating with the divided water discharge ports during a changeover operation. Washing water discharged from the washing water feeding means is thus prevented from simultaneously discharging from the plurality of washing means. Therefore, a small amount of feed water can drive the washing water feeding means, that is a small motor having low power can be used. A mechanism unit can therefore be downsized. A body capable of washing more eating utensils or the mechanism unit is downsized, thereby downsizing body volume. As a result, an installation area required for installing the washer is decreased, and the installing ability is improved.

[0038] At least one of the plurality of discharge ports preferably has a rectangular or substantially elliptical shape circumferentially longer than those of the other discharge ports. A small amount of fed water can thus drive the washing water feeding means, though the plurality of discharge ports have different opening area. Spray time of the washing means to the divided water discharge port is changed periodically in response to longitudinal length of the rectangular shape, thereby preventing interference between the washing means and thus preventing reduction of the washing performance.

[0039] The plurality of discharge ports and divided water discharge ports are preferably arranged in the ro-

tary water dividing unit and the divided water output unit, respectively, so that washing water is always discharged from any one of the washing means during washing. When the rotary water dividing unit rotates, a part or the whole of the opening of the discharge ports certainly matches to the opening of the divided water discharge port wherever the discharge ports lie. Therefore, any one of the washing means can always spray the washing water to eating utensils or the like, and thus washing efficiency is further improved in a limited washing time.

[0040] At least one of the plurality of divided water discharge ports preferably has a rectangular or substantially elliptical shape circumferentially longer than those of the other divided water discharge ports. The feeding/discharging passage, which communicates with this divided water discharge port has a cross section area larger than those of the other feeding/discharging passages. The washing means communicating with the divided water discharge port and the feeding/discharging passage that have the larger cross section area, can therefore repeat the following discharges of washing water: discharge at an usual flow rate and a low pressure and for a long time; and discharge at a large flow rate and a low pressure and for a longer time. This spray of the washing water has a high removing effect of garbage or the like adhered to the eating utensils, and washing from the upper part of the washing tub increases the effect. Variation of discharge pressure or discharge flow rate causes change of spray flow rate and spray angle of the washing means. This allows wider and more efficient washing of the eating utensils or the like.

[0041] The divided water output unit preferably has a passage varying means for varying the passage cross section area of the divided water discharge port or the feeding/discharging passage. Flow rate and pressure of washing water flowing to the washing means communicating with the feeding/discharging passage having the passage varying means are arbitrarily switched. When there are less eating utensils, the passage varying means is fully closed to stop spray from a part of the washing means. This increases the spray time from the other washing means, and exhibits high washing performance in shorter time. For washing extremely soiled eating utensils, high-pressure washing is effective. Narrowing the passage varying means thus allows spray of the washing water at high pressure, and therefore allows speedy washing. The washing method can be thus changed in response to quantity and quality of dirt adhered to the eating utensils or the like.

[0042] The controlling means preferably has an operating method of spraying washing water from any washing means. The washing water discharged from the washing water feeding means can be fed to any washing means by changeover of the discharging passage connecting to each washing means. The washing is therefore performed without increasing fed water. The washing water is thus sprayed to the eating utensils from a plurality of directions though flow rate is low, so that high washing performance is obtained.

[0043] The water dividing means preferably has a rotational position detecting means. The controlling means preferably controls the operating method so that washing water is sprayed from a substantially upper part or side part in the washing tub in closing of at least any rinsing process of a washing process. The washing water is thus sprayed from a substantially upper part in closing of the spraying process of the washing water, so that dirt such as garbage adhered to an object to be washed is prevented from remaining on the object, and the dirt is certainly washed out. Therefore, the dirt such as garbage and the washing water containing the dirt is speedily discharged out of the washer, and the rinsing performance is improved.

[0044] The water dividing means preferably has a structure for arbitrarily controlling a feeding time of washing water to each washing means. The controlling means preferably controls the operating method so that spray time of each washing means is arbitrarily set for spray. The spray time of the washing means for mainly washing eating utensils accommodated into the rack can be arbitrarily set depending on hardness-to-remove of the dirt adhered on the eating utensils. Therefore, even when an extremely dirty object to be washed is included, remaining of the dirt is prevented and the washing performance is improved.

[0045] The controlling means preferably controls the operating method so that first spray time that is spray time of each washing means in a primary washing process is longer than second spray time that is spray time of each washing means in a rinsing process. Thus, the optimum spray of washing water is allowed in each process. For example, washing is focused on a local part in the primary washing process, and the washing water is speedily and widely sprayed in the rinsing process. High washing performance can be therefore realized.

[0046] The water dividing means preferably has a structure for feeding washing water to only a specific washing means. The controlling means preferably controls the operating method so that the washing water is selectively sprayed to eating utensils held in a partial region in the rack. Thus, the washing means can be selectively operated depending on type or amount of objects to be washed. The objects to be washed can be concentratively and efficiently washed.

[0047] For accommodating a substantially equal amount of a substantially identical type of objects to be washed, a plurality of racks are preferably disposed in the washing tub. In other words, the rack structure is not one in which a single rack simply and entirely accommodates the objects type-by-type used by a maximum number of persons, but one in which each of a plurality of racks can accommodate a set of eating utensils used by respective one to three persons. Thus, when less persons have their meals than usual or eating timings of the family are different from each other, the eating

utensils can be washed efficiently and speedily in response to variation of number of eating persons.

[0048] The controlling means preferably controls the operating method so that all washing means sequentially spray washing water in the primary washing process or the rinsing process. In other words, while the washing is performed with the washing means only partially operated, all washing means are temporarily used to wash the entire inside of the washing tub. The inside of the washing tub can be therefore kept clean.

[0049] At least one of feeding/discharging passages preferably communicates with a function means other than the washing means. This requires no new washing passage, and allows washing water discharged from the washing water feeding means to be fed to the function means. This feeding operation is performed by controlling washing flow rate, spray time, and its timing using the water dividing means. Therefore, the function means is inexpensive, and the well-controlled washing water can be directly used. The feeding/discharging passage can be used as a driving source of a movable unit such as an open/close valve disposed in the function means. A solenoid valve or the other driving source is not required.

[0050] At least one of the feeding/discharging passages preferably communicates with a draining passage for draining washing water out of the washer. This allows elimination of a drain pump for draining the washing water in the washing tub. Therefore, volume of a washing mechanism unit can be reduced to reduce volume and cost of a product, or washing volume of the same product can be expanded.

[0051] The function means preferably has a function of a foreign matter collecting means for collecting foreign matters contained in washing water. The foreign matters in the washing water can be thus certainly collected without newly forming a passage for collecting the foreign matters. The washing water used for the final rinsing process does not need to be passed among the foreign matters. The washer can therefore have high rinsing performance.

[0052] At least one of washing means preferably communicates with a washing means for rotating and spraying washing water. A plurality of washing means can thus spray the washing water to objects to be washed from various directions. Therefore, high efficient washing performance can be obtained independently of shapes, setting positions, or a setting method of the objects to be washed.

[0053] The washing water feeding means is preferably vertically installed. The aqueduct of the water dividing apparatus can be thus installed at a level higher than the discharge port of the washing water feeding means and lower than the height of the lower part of the washing tub limited. The level of a mechanism unit (a washing pump, a drain pump, or a fan) formed in the lower part of the washing tub can be lowered.

[0054] A plurality of washing means preferably jet air sequentially. Washing water containing dirt can be thus removed from objects to be washed during a drain operation in the rinsing process. The rinsing performance can be therefore improved. Drying air is efficiently jetted to the objects in a drying process. The drying performance can be therefore improved. The washing water is not sprayed simultaneously from the plurality of washing means, but sprayed sequentially. A small blast means can be used.

[0055] The washing water feeding means preferably has a function as a blast means. Conventionally, when a blast means is newly installed in the washing passage, a mechanism for preventing washing water from intruding into the blast means is required. The washer of the present embodiment, however, does not require the mechanism. The washer is therefore simpler and inexpensive.

[0056] Exemplary embodiments of the present invention will be described hereinafter with reference to the accompanying drawings.

Exemplary embodiment 1

[0057] Fig. 1 is a sectional view of a dishwasher in accordance with exemplary embodiment 1 of the present invention. Fig. 2 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher. Fig. 3 is an exploded perspective view showing a water dividing structure of the dishwasher. Fig. 4 is a fragmentary sectional view showing a driving structure of another water dividing means of the dishwasher. Fig. 5 is a perspective view of still another washing means of the dishwasher. Fig. 6 is a perspective view of still another washing means of the dishwasher. Fig. 7 is a perspective view of still another washing means of the dishwasher. Fig. 8 is a perspective view of still another washing means of the dishwasher. Fig. 9 is a perspective view of still another washing means of the dishwasher. Fig. 10 is a perspective view of still another washing means of the dishwasher.

[0058] In Fig. 1, the dishwasher comprises body 21, washing tub 22, cover 23, exhaust port 24, rack 25, roller 26, rail surface 27, washing pump (washing water feeding means) 28, washing nozzle (washing means) 29, spray port 17, washing nozzle 30, washing nozzle 31, washing nozzle 32, drain pump 33, heater 34, water dividing apparatus 35, and controller (controlling means) 38.

[0059] Cover 23 is used for opening or closing an opening in the washing tub. Exhaust port 24 is formed in cover 23. Rack 25 accommodates eating utensils, and roller 26 rotates. Rail surface 27 is disposed on a side face of washing tub 22. Washing pump (washing water feeding means) 28 pressurizes washing water. Washing nozzle (washing means) 29 is disposed in the lower part of washing tub 22. Washing nozzle (washing means) 30 is disposed in the upper part of washing tub

22. Washing nozzle (washing means) 31 is disposed on the back face of washing tub 22. Washing nozzle (washing means) 32 is disposed on the left face of washing tub 22. Rack 25 is supported by rail surface 27 through rotating roller 26. Washing nozzle 29 sprays the washing water to the eating utensils through spray port 17 while turning.

[0060] The right face of washing tub 22 has a washing nozzle (not shown) that sprays the washing water while turning. A total of five washing nozzles are thus disposed. Washing nozzle 29, washing nozzle 30, washing nozzle 31, washing nozzle 32, and the washing nozzle (not shown) for the right face constitute a washing means. Drain pump 33 drains out of the dishwasher, the washing water reserved in washing tub 22. Heater 34 heats the washing water, and heats air during drying. Heater 34 is disposed in the bottom part of washing tub 22. Water dividing apparatus 35 is disposed in feeding/discharging passage 37 for connecting discharge port 36 in the washing pump with each washing nozzle. Controller (controlling means) 38 controls washing pump 28, drain pump 30, and water dividing apparatus 35.

[0061] In Fig. 2 and Fig.3, the dishwasher comprises aqueduct 39 for guiding the washing water pressurized by the washing pump, a rotary water dividing unit 40, driving motor (driving means) 42, divided water output unit 43, rotating shaft 45, oil seal 46, stationary position sensor 48, and frame 49.

[0062] Rotary water dividing unit 40 has two discharge ports 41 formed in the side face of a substantial cylinder, and discharge ports 41 discharge the washing water guided by aqueduct 39. Rotary water dividing unit 40 is rotated by driving motor (driving means) 42 as a driving source. Divided water output unit 43 involves rotary water dividing unit 40, and has a divided water discharge ports 44 communicating with five feeding/discharging passages 37. Rotating shaft 45 connects a driving shaft (not shown) of driving motor 42 with rotary water dividing unit 40. Divided water output unit 43 has an oil seal 46 for watertightly sealing a gap between it and rotating shaft 45.

[0063] Aqueduct 39, rotary water dividing unit 40, driving motor 42, and divided water output unit 43 constitute a water dividing means. Rotation detecting disk 67 having rotation angle detecting slit 50 and stationary position detecting slit 51 on its peripheral part is coaxially fixed to rotating shaft 45. Rotation detecting disk 67 detects a rotation angle of rotary water dividing unit 40 with rotation angle detecting sensor 47 fixed to aqueduct 39. Stationary position sensor 48 is used for positioning to match a hole position of discharge port 41 to that of divided water discharge port 44. Frame 49 supports the driving motor, and fixes driving motor 42 to aqueduct 39. For supporting driving motor 42, frame 49 for supporting the motor may be structured integrally with aqueduct 39 in a positioned state. Driving motor 42, rotation detecting disk 67, rotation angle detecting sensor 47, stationary position sensor 48 for positioning, and controller 38 constitute a rotation angle detecting means.

[0064] Driving motor 42 described in the present exemplary embodiment has a direct current motor that is easily varied in rotation speed and rotation direction by controller 38. However, driving motor 42 is not limited to this, a geared motor including a change gear may be used in consideration of use at low speed rotation. An alternating current motor may be used depending on a control method or a motor size. In the present exemplary embodiment, as the rotation detecting means for detecting a stationary position and a rotation angle during rotation of rotary water dividing unit 40, a combination of an optical sensor using a light receiving/emitting element and rotation detecting disk 67 for passing or shielding light is used. However, the rotation detecting means is not limited to this, stepping motor 68 capable of controlling change of rotation speed and switching of rotation direction as shown in Fig. 4, or a motor (not shown) including an encoder is used. Such a structure can produce a similar advantageousness.

[0065] Referring to Fig. 5, Fig. 6, Fig. 7, Fig. 8, Fig. 9, and Fig. 10, there are illustrated combinations of washing nozzles disposed at the tips of the water dividing apparatus (not shown). In these drawings, washing water is sprayed sequentially to wash eating utensils and cooking utensils, namely objects to be washed. The washing nozzles are configured as, for example, the following combination: rotating nozzle 52 for spraying the washing water while turning and bar nozzle 53 (Fig. 5); rotating nozzle 54 and fixed nozzle 55 (Fig. 6); two upper and lower rotating nozzles 56, 57 (Fig. 7); two rotating nozzles 61, 62 disposed in the upper part, two rotating nozzles 63, 64 disposed in the lower part, and rotating nozzles 65, 66 disposed on left and right side faces, respectively (Fig. 8); only a plurality of fixed nozzles 58, 59, 60 (Fig. 9); rotating nozzles 130, 131, 132 for spraying the washing water while rotating in a drawer type washer (Fig. 10); or a rotating nozzle and a tower nozzle (not shown). Thus, washing nozzles having a different combination can be used depending on conditions such as a size and a shape of the washing tub, or whether the washer has a single rack or a double-stack rack.

[0066] A basic operation of the dishwasher is similar to that of a conventional dishwasher, and therefore the descriptions of the operation are omitted.

[0067] Operations and functions of water dividing apparatus 35, namely a characteristic structure of the present embodiment, will be hereinafter described. Washing water pressurized by washing pump 28 flows through aqueduct 39, and discharges from discharge port 41 formed in rotary water dividing unit 40. At this time, rotary water dividing unit 40 is rotated by driving motor 42, so that the washing water discharging from discharge port 41, sequentially discharges from five divided water discharge ports 44, and flows to respective washing nozzles. The washing water is sequentially fed to washing nozzle 29 (lower face), washing nozzle for the right face (not shown), washing nozzle 32 (left side

face), washing nozzle 31 (back face), and washing nozzle 30 (upper part). Thus, the washing water is not simultaneously fed to five washing nozzles, but sequentially fed to them. Therefore, the washing water can be sprayed to any object to be washed from a plurality of directions without increasing fed water.

[0068] Dirt adhered to eating utensils or the like can thus be washed out speedily, and high efficient washing can be realized. Detergent or dirt attached to the eating utensils can be rinsed speedily, so that a number of rinsings can be decreased. The number of rinsings can be decreased without increasing water for one feeding. Therefore, heating time of the washing water using the heater can be reduced, and energy and water can be saved.

[0069] A number of washing nozzles can be increased without increasing fed water, so that a washing method can be provided in which the washing water is 10); or a rotating nozzle and a tower nozzle (not shown). Thus, washing nozzles having a different combination can be used depending on conditions such as a size and a shape of the washing tub, or whether the washer has a single rack or a double-stack rack.

[0070] A basic operation of the dishwasher is similar to that of a conventional dishwasher, and therefore the descriptions of the operation are omitted.

[0071] Operations and functions of water dividing apparatus 35, namely a characteristic structure of the present embodiment, will be hereinafter described. Washing water pressurized by washing pump 28 flows through aqueduct 39, and discharges from discharge port 41 formed in rotary water dividing unit 40. At this time, rotary water dividing unit 40 is rotated by driving motor 42, so that the washing water discharging from discharge port 41, sequentially discharges from five divided water discharge ports 44, and flows to respective washing nozzles. The washing water is sequentially fed to washing nozzle 29 (lower face), washing nozzle for the right face (not shown), washing nozzle 32 (left side face), washing nozzle 31 (back face), and washing nozzle 30 (upper part). Thus, the washing water is not simultaneously fed to five washing nozzles, but sequentially fed to them. Therefore, the washing water can be sprayed to any object to be washed from a plurality of directions without increasing fed water.

[0072] Dirt adhered to eating utensils or the like can thus be washed out speedily, and high efficient washing can be realized. Detergent or dirt attached to the eating utensils can be rinsed speedily, so that a number of rinsings can be decreased. The number of rinsings can be decreased without increasing water for one feeding. Therefore, heating time of the washing water using the heater can be reduced, and energy and water can be saved.

[0073] A number of washing nozzles can be increased without increasing fed water, so that a washing method can be provided in which the washing water is sprayed to objects to be washed such as eating utensils from various directions. Therefore, when the user tries to set the objects into the rack, a user need not select setting positions and a setting method of placing the objects vertically or bottom upward. The user can freely set the objects to be washed. The dishwasher can have high setting ability. The dishwasher can have sufficient washing performance even for an eating utensil such as a square bowl, a deep and small bowl, or a square plate that cannot receive sufficient washing water because of spray from a single direction.

[0074] Water dividing apparatus 35 has not a changeover valve or the like in feeding/discharging passage 37. Water dividing apparatus 35 has a mechanism of switching each feeding/discharging passage 37 between substantially cylindrical rotary water dividing unit 40 rotated by driving motor 42 and divided water output unit 43. Therefore, intrusion of a foreign matter into the washing water does not cause malfunction of the changeover valve, and thus the water dividing apparatus can be simple and have unit reliability.

[0075] Two discharge ports 41 are disposed for five divided water discharge ports 44. Vertical and horizontal dimensions of each divided water discharge port 44 are equal to those of each discharge port 41. The washing water can thus simultaneously be fed to two washing nozzles. Spray time in which each washing nozzle sprays the washing water during one rotation of rotary water dividing unit 40 is two times longer than spray time of the case that the number of discharge ports 41 is one. Discharge pressure of the washing water decreases a little, but washing power higher than that in a prior art can be secured. That is because eating utensils held in the upper rack (not shown) are conventionally washed only by the lower washing nozzles, but in the present embodiment, they are washed also with the washing water sprayed from the upper part of washing tub 22. Therefore, amount of washing water sprayed to the objects to be washed per unit time is increased, and the washing performance is improved.

[0076] Driving motor 42 can freely set a rotation speed of rotary water dividing unit 40 with controller 38. For example, when less dirt is adhered to an eating utensil such as a teacup or an eating utensil used for salad, the dirt is instantly washed out and removed from the eating utensil only by spray of washing water. In this case, the spray time from one washing nozzle is not made long, but the rotation speed of rotary water dividing unit 40 is made high and the washing water is sprayed to the eating utensil in unit time from various directions. This allows speedy and more efficient washing. On the contrary, when an extremely dirty eating utensil to which much part of an egg or oil is adhered is washed, the spray time from one washing nozzle during one rotation of rotary water dividing unit 40 is made long. This improves washing performance comparing with a case in which the spray time is not made long. Thus, amount of the washing water sprayed from each washing means is varied in response to quantity and quality of the dirt adhered to

eating utensils, thereby optimizing and thus improving the washing performance, shortening a washing time, or saving energy.

[0077] Using rotation detecting disk 67, rotation angle detecting sensor 47, and stationary position sensor 48 for positioning, driving motor 42 can recognize a relatively positional relation between discharge port 41 in rotary water dividing unit 40 and five divided water discharge ports 44. For example, for reducing washing time, times for sprays from the washing nozzles in the lower part and upper part of washing tub 22 can be made longer than spray times of the other washing nozzles. The spray of the washing water to a cover causes increase of washing noise, but for minimizing the spray the spray time from the washing nozzle on the back face may be shorter than the spray times of the other washing nozzles. Thus, the washing water can be fed to a specific feeding/discharging passage for any time, washing energy can be applied in response to a degree of dirt of the objects to be washed, and the washing performance can be improved. Washing noise can also be reduced.

[0078] Driving motor 42 rotates forwardly or reversely under control of controller 38, so that the motor can arbitrarily rotate clockwise or counter-clockwise. For example, when eating utensils are set only on a right half in the rack in the dishwasher shown in Fig. 8, washing water is sprayed only from rotating nozzles 62, 64, 66 to most efficiently wash the eating utensils. When rotary water dividing unit 40 is rotated only in a single direction, the washing water is also fed to rotating nozzles 61, 63, 65 for washing the left side in the rack where no eating utensil is placed, and therefore washing is inefficient. However, in addition to use of rotation angle detecting sensor 47 and stationary position sensor 48 for positioning, controller 38 controls driving motor 42 to rotate it forwardly or reversely. The washing water can be therefore sprayed to only rotating nozzles 62, 64, 66, and efficient washing is allowed in response to setting positions of eating utensils. As a result, speedy washing is allowed, and energy is saved.

[0079] In a washing method using a plurality of washing nozzles, generally, a feeding/discharging passage is required for each washing nozzle to increase fed water. When only fixed nozzles are used as shown in Fig. 9, many spray ports 17 are required for securing a predetermined washing performance. In the present embodiment, however, at least one or all of washing nozzles are rotating nozzles that spray washing water while turning. Therefore, in spite of a smaller amount of fed water, the washing water can be sprayed to objects to be washed from various directions. High efficiency washing can be obtained independently of shapes, setting positions, and a setting method of the eating utensils.

[0080] The driving means controls the rotary water dividing unit so as to match the opening position of discharge port 41 to that of divided water discharge port 44 during a draining process. This allows the washing water to discharge out of the washer without remaining in the water dividing apparatus, the washing nozzles, and the feeding/discharging passages. Therefore, garbage and detergent components contained in the washing water are discharged, and thus the washing performance and the rinsing performance are improved. The present invention is not limited to the method of matching the position of a discharge port to that of a divided water discharge port, and rotary water dividing unit may be continuously rotated. The latter case also produces a similar advantageousness.

[0081] In the washer of the present embodiment, the following elements do not need to be integrally formed, and each element may be individually formed. The elements are, for example, the means for controlling rotation speed or rotation direction (normal or reverse) of the driving motor, a rotation angle detecting means, and the washing nozzles including a rotating nozzle. A dishwasher has been described in the present embodiment, but the present invention is not limited to this dishwasher. The washer structure of the present embodiment may also be employed for a washer having a process of spraying washing water during the washing and the rinsing for removing foreign matters may also employ. The washer having the process of spraying washing water is, for example, a component washer for removing grease or chips of a component machined by a machine tool or the like, a washer for a semiconductor wafer, or a vegetable washer for removing foreign matters or chemicals from vegetables. In this case, a similar advantageousness is produced.

Exemplary embodiment 2

[0082] Fig. 11 is a sectional view of a dishwasher in accordance with exemplary embodiment 2 of the present invention.

[0083] The washer of the present exemplary embodiment differs from that of exemplary embodiment 1 in the following structure. Washing pump 28 is disposed vertically. Feed water port 81 of the washing pump 28 is disposed in the lower end of the washing pump. Discharge port 36 of the washing pump 28 is disposed in the upper part of feed water port 81 of the washing pump 28 and projects substantially horizontally. Divided water discharge port 44 is disposed higher than discharge port 36. Stationary position sensor 48 for detecting a stationary position of rotary water dividing unit 40 and rotation angle detecting sensor 47 for detecting a rotation angle during rotation of rotary water dividing unit 40 have a micro switch, and rotation detecting disk 67 having concaves is combined with them. In addition to detecting methods shown in exemplary embodiment 1 and exemplary embodiment 2, a detecting method employing a sensor using magnetism may be also used.

[0084] Elements of exemplary embodiment 2 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements

are omitted.

[0085] Operations and functions of the washer will be described hereinafter.

[0086] Washing pump 28 is disposed vertically in the lower part of washing tub 22. In a feed water process for feeding the washing water to washing tub 22, the driving means controls the rotary water dividing unit so as to face the position of discharge port 41 to that of divided water discharge port 44 before the feeding. Otherwise, the driving means controls the rotary water dividing unit to continuously rotate it during the feed water process. In a conventional washer having a horizontally placed washing pump, discharge port 36 of the washing pump is positioned in the upper part. In this case, water dividing apparatus 35 must be disposed in the further upper part, and the height of a mechanism unit must be increased. In the present embodiment, however, washing pump 28 is disposed vertically, so that discharge port 36 of the washing pump can be disposed at a lower position. Therefore, air exhausted from washing pump 28 can flow through water dividing apparatus 35 and smoothly go out of each washing nozzle, even when the mechanism unit is lowered.

[0087] Regarding a positional relation between discharge port 36 and divided water discharge port 44, divided water discharge port 44 is disposed higher than discharge port 36 of the washing pump with reference to the floor surface for receiving body 21. During the water feeding, air from washing pump 28 does not remain in water dividing apparatus 35, and flows into washing tub 22 through washing nozzles 29, 30, 31, 32. This prevents troubles that the air remains in a casing of washing pump 28, entrainment of the air into the washing water occurs, and therefore the washing pump does not work. As a result, washing failure is prevented and stable washing performance can be secured.

[0088] The elements depending on the arrangement of the washing pump and a height relation between the washing pump and the divided water discharge port as described in embodiment 2 do not need to be formed integrally, and these elements may be independently formed.

Exemplary embodiment 3

[0089] Fig. 13 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in a dishwasher in accordance with exemplary embodiment 3 of the present invention. Fig. 14 is an exploded perspective view of a water dividing structure of the dishwasher.

[0090] The washer of exemplary embodiment 3 differs from that of exemplary embodiment 1 in the following structure. A plurality of discharge ports 41 are vertically separated from each other by any distance in the axial direction of rotary water dividing unit 40. Rotation tracks of discharge ports 41 are not identical. Washing/discharging passages 37 having divided water discharge port 44 are disposed on different planes.

[0091] Regarding the displacement of rotation tracks of discharge ports 41, the rotation tracks of discharge ports 41 may be overlapped each other, or the rotation tracks may not be overlapped each other at all. Any one of these structures produces advantageousness of the present invention. When the rotary water dividing unit is formed substantially horizontally, feeding/discharging passages 37 can be formed at any right and left positions of the divided water output unit. Therefore, a washing means, a water dividing means, and the other mechanism units can be arranged optimally.

[0092] Elements of exemplary embodiment 3 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0093] Operations and functions of water dividing apparatus 35, namely a characteristic structure of embodiment 3, will be described hereinafter. Regarding a positional relation of the plurality of discharge ports 41 in rotary water dividing unit 40, discharge ports 41 are disposed at positions where respective rotation tracks of the plurality of discharge ports 41 are not identical. Rotation radius of rotary water dividing unit 40 can be therefore decreased while an opening area is kept equal to that in a structure where discharge ports 41 are disposed on a substantially identical track. Assignment of feeding/discharging passages 37 to a plurality of washing nozzles 29, 30, 31, 32 is facilitated in the lower part of washing tub 22, and thus water dividing apparatus 35 is downsized and the installing ability is improved. Bending frequency of feeding/discharging passages 37 is low, and therefore the pressure loss in feeding/discharging passages 37 can be reduced. As a result, discharge force of washing nozzles is increased and the washing performance is improved, or a washing pump is downsized to further downsize the mechanism unit.

Exemplary embodiment 4

[0094] Fig. 15 is a sectional view of a dishwasher in accordance with exemplary embodiment 4 of the present invention. Fig. 16 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher. Fig. 17 is an exploded perspective view of a water dividing structure of the water dividing means of the dishwasher.

[0095] The washer of exemplary embodiment 4 differs from that of exemplary embodiment 1 in the following structure. One of divided water discharge ports 82 is formed in a face substantially vertical to rotating shaft 45 of rotary water dividing unit 40. Discharge ports 83 are formed in not only a side face of rotary water dividing unit 40 but also a top face of it.

[0096] Elements of exemplary embodiment 4 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0097] Operations and functions of the washer will be described hereinafter. Water dividing apparatus 35 is vertically placed in exemplary embodiment 1, so that all of a plurality of divided water discharge ports 44 discharge the washing water substantially vertically to rotating shaft 45 of rotary water dividing unit 40. The washing water flowing upwardly in rotary water dividing unit 40 discharges from discharge ports 41, changing its flow direction by about 90°. A pressure loss therefore occurs in this stage. Especially, when the washing water is fed to washing nozzle 29 for spraying the washing water from the lower direction, this pressure loss largely affects the washing performance. In exemplary embodiment 4, however, a channel is not bent substantially vertically by rotary water dividing unit 40. Therefore, the washing water guided by aqueduct 39 is fed directly to washing nozzle 29 through discharge port 83 and divided water discharge port 82.

[0098] The pressure loss can be minimized. Therefore, discharge force of washing nozzles is increased and the washing performance is improved, or a washing pump is downsized to further downsize a mechanism unit. The structure discussed above decreases force in a thrust direction that is applied to driving shaft 80 of driving motor 42, and reduces reaction force of the spray (radial force) of the washing water discharged from discharge ports 41 in rotary water dividing unit 40. Therefore, a mounting structure of driving motor 42 is simplified, and an inexpensive dishwasher is obtained.

Exemplary embodiment 5

[0099] Fig. 18 is a sectional view of a dishwasher in accordance with exemplary embodiment 5 of the present invention. Fig. 19 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher.

[0100] The washer of exemplary embodiment 5 differs from that of exemplary embodiment 1 in the following structure.

[0101] Rotary water dividing unit 84 is disposed so that its axis is directed substantially horizontally. Driving shaft 71 of driving motor 86 is disposed in a substantially same direction as a flow direction of washing water discharged from washing pump 28. Driving motor 86 is disposed on the opposite side against discharge port 36 of the washing pump with respect to rotary water dividing unit 84.

[0102] Elements of exemplary embodiment 5 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0103] Operations and functions of the washer will be described hereinafter. Since the axis of rotary water dividing unit 84 is directed substantially horizontally, discharge port 36 of the washing pump, aqueduct 87, and rotary water dividing unit 84 can be arranged substantially coaxially. A plurality of feeding/discharging passages 37 can be horizontally disposed in the side face of rotary water dividing unit 84. Rotary water dividing unit 84 can thus be configured in a slender shape having a small diameter. Pressure loss in a path from discharge port 36 to discharge port 89 can be minimized. Lengths of feeding/discharging passages can be thus optimized for washing nozzles 29, 30, 31, 32 disposed at different positions of washing tub 22. Water dividing apparatus 35 itself can also be disposed in the lower part of the washing tub, and the installing ability of water dividing apparatus 35 is also improved. A water dividing structure where the number of bendings of feeding/discharging passages 37 is less can be obtained, and therefore the passage pressure loss in water dividing apparatus 35 is reduced.

[0104] Regarding the arrangement of driving motor 86, driving motor 86 is disposed on the opposite side against discharge port 36 of the washing pump with respect to rotary water dividing unit 84. Driving motor 86 does not therefore need to be disposed between discharge port 36 and aqueduct 87. When driving motor 86 is disposed between discharge port 36 and aqueduct 87, a water dividing structure where a path between them is bent is required, the pressure loss increases, and a connecting structure between driving shaft 71 and rotating shaft 85 of rotary water dividing unit 84 is complicated.

[0105] In the washer of embodiment 5, however, the pressure loss in a channel is reduced, and the connecting structure between the driving shaft and the rotating shaft of rotary water dividing unit is simplified. A seal mechanism disposed between the rotary water dividing unit and the driving motor can be also formed in a simple structure using an oil seal. Therefore, undesired increase in the cost can be prevented, and the washer is inexpensive.

[0106] The washer of embodiment 5 allows reduction of the pressure loss in each channel where the washing water flows and a water dividing apparatus to be compact. Therefore, the washing performance extremely improves, and a compact and inexpensive dishwasher is obtained.

[0107] The elements depending on the installation direction of the rotary water dividing unit and the installation position of the driving means as described in embodiment 5 do not need to be formed integrally, and each element may be individually formed.

Exemplary embodiment 6

[0108] Fig. 20 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in a dishwasher in accordance with exemplary embodiment 6 of the present invention.

[0109] The washer of exemplary embodiment 6 differs from that of exemplary embodiment 1 in the following structure.

[0110] Any face of a rotary water dividing unit having

discharge port 96 and any face of divided water output unit 97 corresponding to the face of the rotary water dividing unit constitute a cone as shown in Fig. 20.

[0111] Elements of exemplary embodiment 5 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0112] Difference between an entering angle and a going-out angle of the washing water flowing from rotary water dividing unit 95 to divided water discharge port 98 can be therefore reduced due to this structure. Pressure loss in a passage leading from rotary water dividing unit 95 to divided water discharge port 98 can be thus reduced. Discharge pressure of washing nozzles therefore increases. Therefore, the washing performance is improved, a washing pump is downsized, a mechanism unit is further downsized, and therefore the dishwasher can be further downsized. Difference between the entering angle and the going-out angle may be substantially 90° or less on a plane having the discharge port in the rotary water dividing unit and a plane having the divided water discharge port in the divided water output unit. For example, these faces are planar, spherical, or curved. Such structure produces a similar advantageousness.

Exemplary embodiment 7

[0113] Fig. 21 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 7 of the present invention. Fig. 22 is a fragmentary sectional view showing a spray state of the changeover unit of the dishwasher. Fig. 23 is a graph showing water spray force of water sprayed from each washing means of the dishwasher, during one rotation of a water dividing means.

[0114] The washer of exemplary embodiment 7 differs from that of exemplary embodiment 1 in the following structure.

[0115] As shown in Fig. 21, rotation detecting disk (rotational position detecting means, controlling means) 67 having rotation angle detecting slits (rotation angle detecting means) 50 and stationary position detecting slit (rotational position detecting means) 51 on its outer periphery is coaxially fixed to rotating shaft 45. Rotation angle detecting sensor (rotation angle detecting means, sensor using receiving and emitting of light) 47 fixed to aqueduct 39 detects a rotation angle of rotary water dividing unit 40. Stationary position sensor (rotational position detecting means, sensor using receiving and emitting of light) 48 for positioning is disposed at a position where the opening of discharge port 41 matches to that of specific divided water discharge port 44. Stationary position sensor 48 for positioning is used for matching the opening position of discharge port 41 to that of divided water discharge port 44. Rotational position detecting means comprises stationary position sensor 48 for positioning, stationary position detecting slit 51, and rotation detecting disk 67.

[0116] By using rotation angle detecting sensor 47 and stationary position sensor 48, the washing water can be discharged from a specific washing means, and the controlling means can know which discharge port 41 matches to divided water discharge port 44. Stationary position detecting slit 51 is formed at such position that a state where both rotation angle detecting sensor 47 and stationary position sensor 48 detect light or neither of them detects light occurs only once for one rotation of rotation detecting disk 67. A plurality of rotation angle detecting slits 50 formed in rotation detecting disk 67 are formed at positions where the opening of divided water discharge port 44 matches to that of discharge port 41. When only rotation angle detecting sensor 47 detects or does not detect light, thus, a controller discriminates "the opening of divided water discharge port 44 matches to that of discharge port 41". When both rotation angle detecting sensor 47 and stationary position sensor 48 detect light or neither of them detects light, the controller discriminates "rotary water dividing unit 40 comes to a stationary position". Frame (water dividing means) 49 for supporting a driving motor has a function of fixing driving motor 42 to aqueduct 39. Driving motor 42 is supported with frame 49 positioned to aqueduct 39, and these may be integrally structured. Rotary water dividing unit 40, rotating shaft 45, oil seal 46, frame 49 for supporting a driving motor, a driving shaft 80, and driving motor 42 constitute a changeover unit. Aqueduct 39, divided water output unit 43, and changeover unit 101 constitute a water dividing means (water dividing apparatus 35).

[0117] The number of discharge ports 41 in embodiment 7 is one; however, the number is not limited to this. However, the number of discharge ports 41 is preferably smaller than a number of feeding/discharging passages 37. This produces a similar advantageousness.

[0118] Discharge port 41 is formed in the side face of rotary water dividing unit 40 in embodiment 7; however, the present invention is not limited to this. Discharge port 41 may be formed in a face substantially vertical to rotating shaft 45 and faced also to divided water discharge port 44 formed in divided water output unit 43. This produces a similar advantageousness.

[0119] Fig. 22 shows a state where rotary water dividing unit 40 rotates to sequentially match divided water discharge port 44 formed in the side face of rotary water dividing unit 40 to discharge port 41 communicating with each washing nozzle, and thus washing water is sequentially fed to each washing nozzle.

[0120] Fig. 23 shows variation of spray force of each washing nozzle during one rotation of rotary water dividing unit 40.

[0121] Various combinations of washing nozzles are considered in response to a condition such as a single-stack rack or a double-stack rack, but a washing method using a plurality of washing nozzles produces an advantageousness similar to that of embodiment 7.

[0122] Operations and functions of water dividing apparatus (water dividing means) 35, which is a characteristic structure of embodiment 7, will be described hereinafter. Washing water pressurized by washing pump 28 firstly passes through aqueduct 39 and discharges from discharge port 41 formed in rotary water dividing unit 40. At this time, rotary water dividing unit 40 is continuously rotated at a low speed by driving motor 42, and the opening position of discharge port 41 sequentially matches to those of five divided water discharge ports 44. When these opening positions match to each other, the washing water is fed to each washing nozzle through each discharging passage.

[0123] The operations will be described hereinafter. Stationary position sensor 48 and rotation angle detecting sensor 47 function to temporarily stop rotary water dividing unit 40 at a position where divided water discharge port 44 communicating with the lower face of washing nozzle 29 matches to discharge port 41. At this time, the washing water is sprayed from washing nozzle 30 for a certain time. Next, for feeding the washing water to washing nozzle 29, rotary water dividing unit 40 is rotated until discharge port 41 matches to divided water discharge port 44 communicating with washing nozzle 29. After the stop of rotary water dividing unit 40 for the certain time, the rotary water dividing unit is rotated again. Such a series of operations are performed. Fig. 23 shows spray force of each washing nozzle and operations of rotary water dividing unit 40. When rotary water dividing unit 40 is rotated continuously, opening area between discharge port 41 and divided water discharge port 44 gradually changes, and therefore the spray force continuously changes. When rotary water dividing unit 40 is temporarily stopped in an operation, the maximum spray force can be maintained for a certain time.

[0124] The water dividing apparatus can thus switch between discharging passages for the washing water discharged from the washing pump, so that the washing pump power and a fed water amount required for operating a single washing nozzle can operate a plurality of washing nozzles.

[0125] When a conventional structure using only a single nozzle is changed to the structure using a plurality of washing nozzles, the washing performance can be improved using a washing pump having a power equivalent to that of a conventional pump. At this time, the fed water does not need to be increased, so that a longer operating time is not required. Consumed energy and water are saved, and high washing performance is obtained.

[0126] In a conventional washing method where upper and lower nozzles spray water simultaneously, water flows may interfere with each other on an eating utensil to disturb exhibition of original performance. In the washing method of embodiment 7, however, washing water is sequentially sprayed; so that the sprayed washing water flows do not interfere with each other and thus efficient washing is obtained.

[0127] In a primary washing process or a rinsing process in embodiment 7, the controller is controlled so that the washing water is finally sprayed from a washing nozzle disposed on the top face or a side face of the washing tub. The structure is firstly described. Stationary position detecting slit 51 formed in rotation detecting disk 67 is set so that the slit matches to discharge port 41 and divided water discharge port 44 for discharging the washing water to washing nozzle 30 disposed in the upper part of washing tub 22.

[0128] Each washing nozzle sequentially sprays the washing water also in a rinsing process. In closing of the rinsing process, controller 38 performs the following control. Rotary water dividing unit 40 is temporarily stopped based on a signal of stationary position sensor 48 in consideration of the rotation speed and the position of rotary water dividing unit 40 and a certain spray time from the upper part. The washing water is then sprayed from the upper part for the certain time.

[0129] A specific spray method will be illustrated hereinafter.

[0130] The primary washing time and the rinsing time in an operation program are generally set based on timing and temperature of washing water. A heating/rinsing process finally performed in the rinsing process finishes when the temperature of the washing water reaches about 70°. The rinsing process comprises a process of performing a rinsing operation controlled based on two or three time periods and the heating/rinsing process controlled based on the temperature of the washing water. The heating/rinsing process has a process of raising the temperature of the washing water to about 70°.

[0131] In the primary washing process and the rinsing process controlled based on time, therefore, rotary water dividing unit 40 is firstly moved to a stationary position, an operation is then started, a spray time and a stop time of each washing nozzle of rotary water dividing unit 40 are set, and finally the washing water is sprayed from the washing nozzle disposed on the top face or the side face. The controller thus controls the operation.

[0132] The fed water amount and the temperature of the washing water during water feeding vary in the heating/rinsing process, so that finishing timing of the heating and rinsing cannot be specified. However, the stationary position of the rotary water dividing unit is set to a spray position from the washing nozzle disposed on the top face or the side face, thereby finishing the operation when the temperature of the washing water rises to a temperature close to a value for finishing the heating and rinsing. Otherwise, after temperature rising, the washing water is sprayed from the washing nozzle disposed on the top face or the side face and then the operation is finished. In the process of stopping the operation based on a time control, the spray time or the stop time in the operation is changed in response to the finishing timing, thereby realizing the operation of embodiment 7. A performing method of these operations is determined based on a characteristic of any process.

[0133] The washing water is sprayed to eating utensils from the upper part in closing of any process in embodiment 7. Therefore, dirt is easily removed from the eating utensils to allow certain rinsing. Re-adhesion of the dirt to the rim at the bottom of a cup can be minimized. Fine garbage or the like adhered to the eating utensils can be discharged early in the washing process. The washing performance is further improved.

[0134] When the process of performing the rinsing from the upper part is performed in at least several rinsing processes, its advantageousness can be obtained. However, when the rinsing from the upper part is performed in all rinsing processes and the primary washing process, the advantageousness is further improved.

[0135] Regarding the spray time of each washing means, the controller controls rotation angle detecting sensor 47, stationary position sensor 48, and driving motor 42 in a structure of embodiment 7, and thus the spray time of the washing water from each washing means can be arbitrarily set. Dirt adhered to eating utensils is easily removed or is hardly removed depending on types of the dirt, when the eating utensils are washed. For example, a grain of rice or the like adhered to a rice bowl is hardly removed, and dirt on a teacup or the like is relatively easily removed. The rack in the dishwasher is designed so that setting positions of the eating utensils in response to types of the eating utensils are restricted to some extent. A spray mechanism from the washing nozzles is designed in response to this.

[0136] The washing nozzle for spraying the washing water toward a setting position of the teacup having the hardly removed dirt requires a long spray time in embodiment 7. A washing nozzle for spraying the washing water to a vessel for small articles also requires a spray time longer than that of the other washing nozzles. Here, the dirt adhered to the vessel is easily removed by the spray from the upper part. Thus, a spray time of each washing nozzle can be set, in consideration of easiness of removal of the dirt and a spray direction where the dirt is easily removed depending on an eating utensil arrangement. As an example, a spray time of each washing nozzle is set so that spray times for a place having hard-to-remove dirt, a place having easy-to-remove dirt, and the other places are 30 seconds, 5 seconds, 10 seconds, respectively.

[0137] In the dishwasher accommodating eating utensils having differently hard-to-remove dirt, thus, the operation having an optimal spray time corresponding to characteristics of eating utensils and dirt allows more efficient washing, prevents washing failure, and provides high washing performance.

[0138] Spray times in the primary washing process and the rinsing process will be described hereinafter. The spray time is defined as shown below in embodiment 7. The spray time means a certain time in which any washing nozzle sprays the washing water in a state where discharge port 41 is stopped temporarily. Especially, the spray time in the primary washing process is called a first spray time, and the spray time in the rinsing process is called a second spray time.

[0139] The controller in embodiment 7 is operated so that the first spray time is longer than the second spray time. In the primary washing process, essentially, a chemical force due to detergent and a washing force due to heat are combined for washing in order to remove dirt adhered to eating utensils from the eating utensils. Especially, in the case of using of a machine force generated by the spray of the washing water, high washing performance is obtained by spraying a large quantity of washing water at a time, rather than by spraying a small quantity of washing water several times. On the contrary, in the rinsing process, a spraying of the washing water and several water dischargings and water feedings are repeated in a short time to mainly wash away fine dirt adhered to the eating utensils or the inside of the washing tub. The eating utensils are more certainly rinsed in a short time by spraying the washing water to the eating utensils uniformly from the most possible directions. In other words, preferably, the first spray time is set long and the washing is certainly performed, and the second spray time is set short and the number of sprayings from each washing nozzle is increased. As an example, preferably, the first spray time is 10 seconds, and the second spray time is 5 seconds.

[0140] In the washing in embodiment 7, therefore, the optimal spray time of each washing nozzle is set, thereby realizing high washing performance.

[0141] The water dividing structure illustrated in embodiment 7, the operating method of spraying the washing water from the upper part in closing of the operation, spray time difference between the primary washing process and the rinsing process, and the operating method allowing setting of the spray time of each washing nozzle in any process do not need to be wholly realized. For example, each process or each element may be independent. All processes in the washing process do not need to be performed. For example, at least one process in it may be performed, and a similar advantageousness can be produced.

[0142] The rotary water dividing unit in embodiment 7 mainly rotates and stops repeatedly; however, the present invention is not limited to this. A rotary water dividing unit may be continuously moved. In the latter case, the rotation speed is varied to perform an operation similar to that in embodiment 7. Thus, a similar advantageousness can be produced. A structure in which the rotary water dividing unit rotates at a constant speed is also allowed, and a similar advantageousness can be produced.

Exemplary embodiment 8

[0143] Fig. 24 is a fragmentary sectional view showing a double-stack rack of a dishwasher in accordance with exemplary embodiment 8. Fig. 25 is a fragmentary perspective view of a water dividing means of the dish-

washer.

[0144] The washer of exemplary embodiment 8 differs from that of exemplary embodiment 1 in the following structure.

[0145] The rack of the dishwasher comprises upper rack 121 and lower rack 122. Washing water discharged from discharge port 102 formed in rotary water dividing unit 124 is discharged to two washing nozzles; washing nozzle 72 for the upper rack and washing nozzle 73 for the lower rack. Divided water output unit 126 therefore has two divided water discharge ports 75.

[0146] Basic structures and operations of the water dividing means in exemplary embodiment 8 are similar to those in exemplary embodiment 1. Elements of exemplary embodiment 8 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0147] Operations and functions will be described hereinafter. As discussed above, the dishwasher of embodiment 8 has a structure in which the rack comprises the upper and lower racks and the upper and lower racks have washing nozzles 72, 73, respectively. In this structure, washing water can be sequentially sprayed to usual upper and lower washing nozzles using water dividing apparatus 35, and further washing nozzle 72 for the upper rack or washing nozzle 73 for the lower rack can be easily individually operated. For washing eating utensils such as cups low in height together, for example, a user sets the eating utensils into upper rack 121, pushes an upper rack washing course switch (not shown) formed on an operating unit (not shown) to select a washing course for the eating utensils in the upper rack. At this time, discharge port 102 rotates until it faces divided water discharge port 75 communicating with washing nozzle 72 for the upper rack. The washing water is sprayed from washing nozzle 72 to wash the eating utensils in upper rack 121. A water amount fed to washing tub 22 is less than that for washing the eating utensils accommodated in both the upper and lower racks. Therefore, the time required for raising washing temperature is reduced, and the washing time can be reduced.

[0148] For washing large cooking utensils such as a bowl, a pan, and a frying pan used for cooking, these cooking utensils are set into lower rack 122 capable of easily holding bulky eating utensils having large volume. A lower rack washing course switch (not shown) formed on the operating unit (not shown) is pushed to wash these cooking utensils. An operation of discharge port 102 is opposite against the operation discussed above, and discharge port 102 rotates until it faces divided water discharge port 75 communicating with washing nozzle 73 for the lower rack. The washing water is sprayed from washing nozzle 73 to wash the eating utensils in lower rack 122. Thus, the water consumption is reduced and the washing time can be reduced, similarly to the case of washing of the upper rack. The power consumption is also reduced.

[0149] In embodiment 8, a washing means can be selectively operated in response to types or volume of eating utensils. The eating utensils can be concentratively and efficiently washed.

Exemplary embodiment 9

[0150] Fig. 26 is an exploded perspective view of a water dividing means of a dishwasher in accordance with exemplary embodiment 9 of the present invention. Fig. 27 is a perspective view showing spray of washing water in the dishwasher. Fig. 28 is a sectional view showing a rack state in the dishwasher.

[0151] The washer of exemplary embodiment 9 differs from that of exemplary embodiment 1 in the following structure.

[0152] A body, of which depth is shorter than width, includes two washing nozzles disposed in the lower part of a washing tub, and a water dividing means, as shown in Fig. 26, Fig. 27, and Fig. 28. Thus, only left rack 110 or right rack 111 can be washed. An operation of sequentially spraying the washing water from all washing means is performed in any washing process.

[0153] Basic structures and operations of the water dividing means in exemplary embodiment 9 are similar to those in exemplary embodiment 1. Elements of exemplary embodiment 9 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0154] In Fig. 26, the washing water is sprayed only to the left rack or the right rack. Driving motor 86 is formed of a direct current motor capable of rotating forwardly and reversely, and four divided water discharge ports communicating with left and right washing nozzles 90, 91, 92, 93 are formed of divided water discharge port 103 for the lower left washing nozzle, divided water discharge port 104 for the upper left washing nozzle, divided water discharge port 105 for the upper right washing nozzle, and divided water discharge port 106 for the lower right washing nozzle. For washing only the left rack, controller 38 controls rotary water dividing unit 40 to forwardly and reversely rotate it between divided water discharge port 103 for the lower left washing nozzle and divided water discharge port 104 for the upper left washing nozzle. For washing only the right rack, controller 38 controls rotary water dividing unit 40 to forwardly and reversely rotate it between divided water discharge port 105 and divided water discharge port 106.

[0155] In Fig. 27, the washing nozzles comprise lower left washing nozzle 90, upper left washing nozzle 91, upper right washing nozzle 92, and lower right washing nozzle 93. Operating unit 94 includes operating switch 185 for making right and left washing nozzles sequentially spray the washing water, left operating switch 186 for making upper and lower washing nozzles on the left side alternately spray the washing water, right operating switch 187, and an washing course selecting switch 188 for being selected in response to dirt of eating utensils.

[0156] In Fig. 28, washing tub 22 is provided with two

racks, left rack 151 and right rack 152, and these racks can be drawn independently. Respective rack configurations of left rack 151 and right rack 152 are the same. The same volume of eating utensils having the same configuration can be set into each rack.

[0157] Functions for independently washing eating utensils accommodated in left rack 151 and right rack 152 will be firstly described. As well known in a common home, volume of eating utensils set into the dishwasher and setting timing vary between a weekday and a holiday, or between breakfast or dinner and lunch. For example, in a conventional dishwasher, when a dinner timing of a housewife and a child differs from that of a master, generally, eating utensils of the master as the last to have the dinner are set into the rack, and then a washing operation for the eating utensils of all members is started. In this method, however, the eating utensils of the housewife and the child that are firstly set into the rack are let stand for a long time until the operation of the dishwasher. Therefore, disadvantageously, dirt adhered to the eating utensils is hardly removed, and washing quality is degraded. Another disadvantageousness occurs when eating utensils corresponding to a half of the number of members are set into one rack, for example, when plates are set on the left side in the rack and rice bowls are set on the right side in the rack. In other words, all washing nozzles must be operated in order to wash the eating utensils, in spite of a half volume of eating utensils.

[0158] In embodiment 9, however, a half volume of eating utensils can be washed with less fed water, so that eating utensils having the dirt are not let stand uselessly and clearing of the table can be finished early.

[0159] When a washing operation is repeated using only part of a plurality of washing nozzles, generally, garbage or soil water partially accumulates on the non-used side in the washing tub, and therefore generates odor and is unsanitary.

[0160] In the structures described in embodiment 9 and embodiment 8, however, an operation of sequentially spraying washing water from all washing means is performed in a primary washing process or in a rinsing process. Therefore, even when only part of washing means is operated, the entire inside of the washing tub is washed with all washing means and thus the inside of the washing tub can be kept clean.

[0161] The function and the operating method using a plurality of racks and the operating method of sequentially spraying washing water from all washing means in closing of a process do not need to be wholly performed. For example, each of them may be independently performed.

Exemplary embodiment 10

[0162] Fig. 29 is an exploded perspective view of a water dividing structure of a dishwasher in accordance with exemplary embodiment 10 of the present invention. Fig. 30 is a fragmentary sectional view of a changeover unit of the dishwasher.

[0163] The washer of exemplary embodiment 10 differs from that of exemplary embodiment 1 in the following structure.

[0164] Two discharge ports 41 are arranged not to simultaneously match to divided water discharge port 44, as shown in Fig. 29 and Fig. 30. A positional relation of them is kept so that passage pressure loss does not occur when rotary water dividing unit 40 rotates to match discharge port 41 to divided water discharge port 44 and washing water from discharge port 41 flows into divided water discharge port 44.

[0165] Two discharge ports 41 are arranged on the same circumference of rotary water dividing unit 40 in embodiment 10. Two additional discharge ports 41 may be formed on a different circumference, but in this case, it is prohibited that all discharge ports 41 match to a plurality of divided water discharge ports 44. Thus, high advantageousness is produced.

[0166] In Fig. 30, rotary water dividing unit 40 rotates to sequentially match divided water discharge ports 44 formed in the side face of the rotary water dividing unit to discharge ports 41 communicating with respective washing nozzles and to sequentially feed the washing water to respective washing nozzles. An effective opening area between discharge port 41 and divided water discharge port 44 continuously varies with rotating rotary water dividing unit 40. When the effective opening area is maximum, namely when discharge port 41 matches to divided water discharge port 44, maximum flow rate is supplied to the washing nozzle. At this time, variation of the effective opening area occurs at two points. Discharge port 41 and divided water discharge port 44 are arranged so that the sum of the effective opening areas at two points substantially equals to an area of one discharge port 41. The effective opening area determined by a relative positional relation between discharge ports 41 and divided water discharge ports 44 is used for determining a circulated flow rate of a washing pump. The effective opening area is suppressed to a value that is derived by subtracting the area of one discharge port 41 from the area of all discharge ports 41. Thus, when there are three discharge ports 41, the discharge ports 41 are arranged so as to suppress the effective opening area to the area of about two discharge ports 41. For feeding the washing water to all washing nozzles at a time, a large washing pump is required and the fed water must be increased. Disadvantageously, a mechanism unit is enlarged, the washing time is elongated, and water consumption is increased. The effective opening area depends on the number of washing nozzles, the number of discharge ports, and power of the washing pump. For reducing fed water, the effective opening area may be suppressed to a value not smaller than a value that is derived by subtracting the area of one discharge port from the area of all discharge ports.

[0167] In such conventional washer employing a plu-

rality of washing nozzles, the washing water must be simultaneously fed to washing nozzles, and therefore a large washing pump and much fed water are required.

[0168] In the washer in embodiment 10, however, a water dividing apparatus can switch between discharging passages of washing water discharged from a washing pump. Therefore, the washing pump's power and the fed water amount required for operating a single washing nozzle can operate a plurality of washing nozzles.

[0169] As a result, the mechanism unit and products are downsized. Capacity for eating utensils is expanded, energy and water are largely saved, and the operating time is shortened.

Exemplary embodiment 11

[0170] Fig. 31 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 11 of the present invention.

[0171] The washer of exemplary embodiment 11 differs from that of exemplary embodiment 1 in the following structure.

[0172] As shown in Fig. 31, the opening of one discharge port 41a of two discharge ports has a rectangular or substantially elliptical shape circumferentially longer than that of another discharge port 41b. Rotary water dividing unit 40 is rotated by driving motor 42 that simply continuously rotates at a constant speed without requiring the detection of a position or a rotation angle. Basic structures and functions for forming a water dividing means are similar to those of exemplary embodiment 1. Elements of exemplary embodiment 11 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0173] Operations and functions will be described hereinafter. Since a plurality of divided water discharge ports 44 have the same shape and rotary water dividing unit 40 rotates at a constant speed, spray time of the washing water by each washing nozzle for one spray increases with increasing circumferential circular arc length of the discharge port. When the washing water is discharged from two discharge ports having different circular arc length to respective divided water discharge ports 44, the washing water is sprayed from one washing nozzle alternately in two different spray times. Especially, when there are many washing nozzles and discharge ports, the washing water is sprayed simultaneously from a plurality of washing nozzles, and therefore washing waters sprayed from adjacent washing nozzles interfere with each other to degrade washing performance. Specifically, when the washing waters collide against each other before collision of the washing waters against eating utensils, washing energy applied to dirt adhered to the eating utensils reduces. When a washing water flow collides against a washing water flow on an eating utensil for rinsing garbage, the rinsing performance is reduced. Degradation of the washing performance thus occurs.

[0174] In exemplary embodiment 11, however, spray timings of washing waters from respective washing nozzles can be arbitrarily staggered. The washing waters sprayed from respective washing nozzles can be therefore prevented from interfering with each other, and the degradation of the washing performance which disadvantageously occurs in a simultaneously washing method of multi washing nozzles can be extensively reduced. Stable and high washing performance, energy saving, and speedy washing can be realized.

[0175] The driving motor of the rotary water dividing unit continuously operates in embodiment 11, so that the speed of the driving motor does not need be varied and a detecting unit for a position of a feeding/discharging passage is not required. This simplifies the structure and reduces the cost.

Exemplary embodiment 12

[0176] Fig. 32 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 12 of the present invention.

[0177] The washer of exemplary embodiment 12 differs from that of exemplary embodiment 10 in the following structure.

[0178] As shown in Fig. 32, discharge ports are arranged in a rotary water dividing unit so that any one of washing means discharges washing water. Basic structures and operations of the water dividing means are similar to those in exemplary embodiment 1. Elements of exemplary embodiment 12 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0179] Operations and functions will be described hereinafter. In an operation in which rotary water dividing unit 40 is rotated to direct the washing water discharged from washing pump 28, a plurality of discharge ports 41 always communicate with one divided water discharge port 44, and the washing water is not simultaneously discharged to the washing passages. The washing water is always sprayed from one place while the plurality of washing nozzles are sequentially switched. Washing pump 28 requires pump power for dashing water corresponding to only one discharge port 41, though washing pump 28 has the plurality of washing nozzles and discharge port 41. When a small washing pump with a small flow rate can be used, fed water reserved into washing tub 22 can be reduced. The reduction of the flow quantity can further shorten warming time of the washing water. Energy saving, speedy washing, and water saving can be realized. The washing pump can be downsized, so that a space of a mechanism unit in a body can be reduced and therefore a dishwasher having expanded washing capacity is obtained. A body dimension is reduced. The downsizing of the body improves the installing ability that most severely disturbs the spread of dishwashers.

[0180] The washing energy, namely the product of discharge pressure and discharge flow quantity , in embodiment 12 is less than that in embodiment 1. However, the fed water of the washer in embodiment 12 can be reduced than that of the washer in embodiment 1. Therefore, the warming time of the washing washer in the washer in embodiment 12 is shortened, more thermal energy can be applied to eating utensils, and thus high washing performance can be kept.

Exemplary embodiment 13

[0181] Fig. 33 is a fragmentary perspective view of a changeover unit of a dishwasher in accordance with exemplary embodiment 13 of the present invention. Fig. 3 and Fig.4 is a sectional view of a passage varying means of the dishwasher

[0182] The washer of exemplary embodiment 13 differs from that of exemplary embodiment 10 in the following structure.

[0183] As shown in Fig. 13 and Fig. 14, discharge ports in rotary water dividing unit 40 are rectangular, and have two types of openings: normal type discharge port 41b and horizontally long type discharge port 41a. Divided water discharge ports also have two types of openings; normal type divided water discharge port 45b and horizontally long type divided water discharge port 45a. Washing/discharging passage 70 communicating with horizontally long type divided water discharge port 45a and spray port 17 of washing nozzle 150 have a larger cross section area than that of feeding/discharging passage 37. A passage varying means for varying passage cross section area is disposed in horizontally long type feeding/discharging passage 70 of divided water output unit 43. Variable valve 172 is turnably disposed in feeding/discharging passage 70. Spring 74 disposed on turning shaft 173 of variable valve 172 presses variable valve 172 against the inner wall of feeding/discharging passage 70. Rod 177 has a function of pressing variable valve 172. Rod 177 is slidably mounted on the wall face of feeding/discharging passage 70 via oil seal 178. Rod 177 linearly slides between pinion 179 disposed on rod 177 and rack 182 mounted on rod driving motor 181, thereby varying the passage cross section area. A turning angle of variable valve 172 is detected by detecting an initial position and a stroke of rod 177.

[0184] Variable valve 172, turning shaft 173, spring 74, rod 177, oil seal 178, pinion 179, rod driving motor 181, and rack 182 constitute the passage varying means. For moving the rod, a mechanism for moving the rod with a solenoid coil, an air pump, a fluid pump, or a cam is used, besides the rack or the pinion (not shown).

[0185] Basic structures and functions for forming a water dividing means are similar to those of exemplary embodiment 1. Elements of exemplary embodiment 13 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0186] Operations and functions will be described hereinafter. Spray time of washing water from a washing'means, spray pressure, and spray flow quantity can be variously changed with a matching manner between each discharge port and each divided water discharge port. For example, when washing nozzle 88 communicating with normal opening type divided water discharge port 45b overlaps on normal opening type discharge port 41b, washing water is sprayed at normal pressure A1 and normal flow quantity B1 and for a spray time. Next, when washing nozzle 88 overlaps on horizontally long type discharge port 41a, the washing water is sprayed at normal pressure A1 and normal flow quantity B1 and for spray time C2 longer by time corresponding to the horizontally long length.

[0187] When washing nozzle 189 with a large flow rate communicating with horizontally long type divided water discharge port 45a overlaps on normal opening type discharge port 41b, washing water is sprayed at slightly low pressure A2 and normal flow quantity B1 and for spray time C2. Next, when washing nozzle 189 overlaps on horizontally long type discharge port 41a, the washing water is sprayed at low pressure A3 and large flow quantity B2 and for further long spray time C3. In other words, A1>A2>A3, B1<B2, and C1<C2<C3.

[0188] A washing time of a specific washing means can be therefore set longer than usual. High advantageousness is produced for washing of stubborn dirt such as a grain of rice. Spray of the washing water at the low pressure but large flow rate is highly effective for rinsing garbage attached to eating utensils. When the washing water is sprayed from the upper part of washing tub 22, the washing effect is further improved. Variation of the discharge pressure or discharge flow quantity causes change of the flow rate or the spray angle of the washing means. A dishwasher for washing eating utensils more widely and highly efficiently is obtained.

[0189] When few eating utensils are washed, a passage varying means is perfectly closed to stop the spray from part of washing means. At this time, spray time of the other washing means increases. Therefore, high washing performance can be exhibited for a shorter time.

[0190] When eating utensils having stubborn dirt are washed, high-pressure washing is effective. The passage varying means is narrowed to allow the spray of high-pressure washing water. Therefore, speedy washing is allowed. A dishwasher that changes a washing method in response to quantity and quality of the dirt adhered to eating utensils is thus obtained.

[0191] Discharge ports or feeding/discharging passages described in embodiment 13 may have a substantially rectangular, circular, or elliptic cross section, or combination of them. Such structure can produce a similar advantageousness. The structure in which the feeding/discharging passages have a passage change-

over unit has been described in embodiment 13, but the present invention is not limited to this. The passage changeover unit may be disposed in a divided water discharge unit to vary opening area of the divided water discharge ports. This produces a similar advantageousness. Opening shapes of the divided water discharge ports and the passage varying means do not need to be realized integrally. For example, elements can be independently formed. The washing nozzle for washing a hard-to-wash grain of rice is set to discharge the washing water for a longer time than the other washing nozzles, thereby shortening the washing time.

Exemplary embodiment 14

[0192] Fig. 35 is a perspective view of a changeover unit of a dishwasher in accordance with exemplary embodiment 14 of the present invention. Fig. 36 is a fragmentary sectional view of the changeover unit of the dishwasher. Fig. 37 is a graph showing variation in discharge pressure of each washing nozzle and a washing pump per cycle of a rotary water dividing unit of the dishwasher.

[0193] The washer of exemplary embodiment 14 differs from that of exemplary embodiment 1 in the following structure.

[0194] As shown in Fig. 35, Fig. 36, and Fig. 37, divided water discharge ports 44 and feeding/discharging passages 37 communicating with them have two types of combinations having a different passage cross section area. A passage cross section area of a first combination of first divided water discharge port 44a and first feeding/discharging passage 37a communicating with it is larger than an opening area of discharge port 41. This passage cross section area is further larger than passage cross section area of the other four combinations of second divided water discharge ports 44b and second feeding/discharging passages 37b communicating with them. When rotary water dividing unit 40 rotates to match discharge port 41 to first divided water discharge port 44a, they keep such a positional relation that passage loss does not occur when washing water from discharge port 41 flows into divided water discharge port 44a. Only one first divided water discharge port 44a has an opening area larger than that of discharge port 41 in embodiment 14, but the present invention is not limited to this. Two, three, or all of the other divided water discharge ports 44 may have an opening area larger than that of discharge port 41. This case also produce a similar advantageousness.

[0195] In Fig. 36, rotary water dividing unit 40 rotates to sequentially match divided water discharge ports 44 formed in its side face to discharge port 41 communicating with each washing nozzle, thereby sequentially feeding the washing water to each washing nozzle. Fig. 36 shows a structure where discharge port 41 is formed in the cylindrical side face of rotary water dividing unit 40 and a structure where discharge port 41 is formed in a plane part formed on the cylindrical side face. When discharge port 41 is formed in the cylindrical side face of rotary water dividing unit 40, circumferential direction length L2 of discharge port 41 is equal to or longer than circular arc length L1 between adjacent divided water discharge ports 44. When discharge port 41 is formed in the plane part disposed on the cylindrical side face of rotary water dividing unit 40, length L3 of discharge port 41 is equal to or longer than circular arc length L1. This point is different from that of embodiment 1.

[0196] Fig. 37 shows variation in spray force of each washing nozzle and discharge pressure of washing pump 28 for one rotation of rotary water dividing unit 40.

[0197] Basic structures and functions for forming a water dividing means are similar to those of exemplary embodiment 1. Elements of exemplary embodiment 14 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0198] Operations and functions of water dividing apparatus (water dividing means) 35, namely a characteristic structure of exemplary embodiment 14, will be described hereinafter. The washing water pressurized by washing pump 28 firstly flows through aqueduct 39 and discharges from discharge port 41 formed in rotary water dividing unit 40. At this time, rotary water dividing unit 40 is continuously rotated at a low speed by driving motor 42, and the opening position of discharge port 41 sequentially matches to the opening positions of five divided water discharge ports 44. When the opening positions match to each other, the washing water is fed through respective feeding/discharging passages 37 to washing nozzle 29 (lower face), a washing nozzle for the right side face (not shown), washing nozzle 31 (back face), washing nozzle 32 (left side face), and washing nozzle 30 (top face), sequentially. Since divided water discharge port 44a and feeding/discharging passage 37a have the passage cross section larger than the opening area of discharge port 41, passage pressure loss caused by switching between washing water's directions can be reduced. Therefore, a smaller washing pump can be used. Therefore, energy consumption, noise, and cost can be reduced.

[0199] Since circumferential length L2 of discharge port 41 is equal to or more than circular arc length L1 between adjacent divided water discharge ports 44, discharge port 41 certainly matches to any divided water discharge port 44 wherever discharge port 41 lies during the rotation of rotary water dividing unit 40. Therefore, a trouble that no washing nozzle discharges the washing water is prevented. The washing pump is prevented from being closed, thereby mitigating pressure rising of each part in the feeding/discharging passage, preventing the washing water from leaking out of the dishwasher through a seal part or a joint part, and improving durability.

[0200] The opening area and the opening length of the divided water discharge port described in embodi-

ment 14 do not need to be wholly realized, and the elements can be independently formed.

Exemplary embodiment 15

[0201] Fig. 38 is a sectional view of a water dividing structure of a dishwasher in accordance with exemplary embodiment 15 of the present invention. Fig. 39 is an exploded perspective view of the water dividing structure of the dishwasher.

[0202] The washer of exemplary embodiment 15 differs from that of exemplary embodiment 14 in the following structure.

[0203] As shown in Fig. 38 and Fig. 39, divided water discharge port 76 has a rectangular shape circumferentially longer than that of discharge port 41. First feeding/discharging passage 77 comprises two passages: passage 78 having a cross section area that changes from a cross section area of first divided water discharge port 76 to that of second feeding/discharging passage 37b; and passages 79 having a cross section equal to that of second divided water discharge ports 44b. Rotary water dividing unit 40 is rotated by driving motor 125 that simply continuously rotates at a constant speed without requiring the detection of a position or a rotation angle. Basic structures and functions for forming a water dividing means are similar to those of exemplary embodiment 1. Elements of exemplary embodiment 15 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0204] Operations and functions will be described hereinafter. Since rotary water dividing unit 40 is rotated at the constant speed, spray time of washing water by each washing nozzle for one spray increases with increasing circumferential circular arc length of the divided water discharge port. First divided water discharge port 76 has a rectangular shape circumferentially longer than that of discharge port 41. Therefore, the spray time of the washing nozzle is longer than those of the other washing nozzles.

[0205] The washing nozzle for washing out a conventionally hard-to-wash grain of rice is set to discharge the washing water for a longer time than those of the other washing nozzles, thereby shortening the washing time. For performing the operation discussed above, conventionally, there has been problems related to the volume and cost. For example, speed of the driving motor for rotating the rotary water dividing unit must be varied and a detecting unit for detecting positions of the feeding/discharging passages is required. However, the washer of embodiment 15 does not require these elements. A simple and inexpensive washer is therefore obtained.

[0206] Since passage 78 having a cross section that changes from a cross section of first divided water discharge port 76 to that of second feeding/discharging passage 37b is provided, the expansion of the passage can be prevented from increasing circulated washing water. Therefore, reduction of fed water allows shortening of warming time, and the washing time and energy consumption can be reduced.

[0207] The discharge port or the feeding/discharging passages described in embodiment 15 may have a substantially rectangular, circular, or elliptic cross section, or combination of them. Any shape can produce a similar advantageousness. The opening shape of the first rotary water dividing unit and a variable passage discussed in embodiment 15 do not need to be wholly realized, and the elements can be independently formed.

Exemplary embodiment 16

[0208] Fig. 40 is a fragmentary sectional view of a changeover unit of a dishwasher in accordance with exemplary embodiment 16 of the present invention. Fig. 41 is a graph showing variation in discharge pressure of each washing nozzle and a washing pump per cycle of a rotary water dividing unit of the dishwasher.

[0209] The washer of exemplary embodiment 16 differs from that of exemplary embodiment 1 in the following structure.

[0210] As shown in Fig. 40, circumferential direction length of discharge port 41 is equal to or longer than the sum of circular arc length of divided water discharge port 44 and circular arc length between divided water discharge ports 44. Basic structures and functions for forming a water dividing means are similar to those of exemplary embodiment 1. Elements of exemplary embodiment 16 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0211] In embodiment 16, during the rotation of rotary water dividing unit 40, a feeding/discharging passage having an area equal to the opening area of discharge port 41 can be secured wherever discharge port 41 lies. Only steady load is applied to washing pump 28 as shown in Fig. 40, a circulated washing water amount discharged from a washing pump can be always kept constant. Therefore, pressure applied to a connection part or a seal part in the feeding/discharging passage is prevented from varying, and endurance reliability is prevented from degrading. Individual washing energy discharged from each washing means varies periodically, but the entire washing means can always apply constant washing energy to eating utensils. Therefore, the eating utensils can be washed efficiently.

Exemplary embodiment 17

[0212] Fig. 42 is a sectional view of a dishwasher in accordance with exemplary embodiment 17 of the present invention.

[0213] The washer of exemplary embodiment 17 differs from that of exemplary embodiment 1 in the following structure.

[0214] As shown in Fig. 42, fan 191 is disposed via

open/close valve 190 in feeding/discharging passage 37 between washing pump 28 and water dividing apparatus 35.

[0215] Basic structures and functions for forming a water dividing means are similar to those of exemplary embodiment 1. Elements of exemplary embodiment 17 similar to those in exemplary embodiment 1 have the same reference numbers, and descriptions of those elements are omitted.

[0216] Open/close valve 190 and fan 191 constitute a blowing means.

[0217] Open/close valve 190 is closed so as to prevent washing water in a washing passage from intruding into fan 191 during washing. When drying air is intended to be jet, open/close valve 190 is opened. At this time, the drying air is jet to eating utensils sequentially from valious washing nozzles with water dividing apparatus 35.

[0218] Thus, the air can be sequentially jet from a plurality of washing nozzles in the structure of exemplary embodiment 17. The washing water containing dirt can be removed from the eating utensils during a draining operation in a rinsing process, so that the rinsing performance improves. The drying air is efficiently jet to the eating utensils in a drying process, so that the drying performance improves. The air is jet not simultaneously but sequentially from a plurality of washing means, so that a small blowing means can be used. Especially when components are overlapped and accommodated in a rack in a component washer for washing the components, the drying air is jet from various directions and therefore the drying time can be extremely reduced.

[0219] Washing pump 28 may be used as the blowing means itself (not shown). Rotation speed of washing pump 28 is increased in this structure, thereby jetting high-pressure air to eating utensils.

[0220] Washing nozzles efficiently jet drying air to the eating utensils while rotating, so that soil water can be widely removed in the rinsing process, the rinsing performance further improve, and the speed drying of the eating utensils is allowed. This structure requires no open/close valve, so that the structure can be realized more simply and at a low cost.

Exemplary embodiment 18

[0221] Fig. 11 is a sectional view of a dishwasher in accordance with exemplary embodiment 18 of the present invention. Fig. 11 is the same as the view of the dishwasher in accordance with exemplary embodiment 2 discussed above. Fig. 12 is a fragmentary sectional view showing a structure of a water dividing means and flow of washing water in the dishwasher.

[0222] The washer of exemplary embodiment 18 differs from that of exemplary embodiment 1 in the following structure.

[0223] As shown in Fig. 11, one of feeding/discharging passages 37 is communicated with draining passage (function means) 69. Another feeding/discharging passage 37 is communicated with garbage collecting filter (function means, foreign matter collecting means) 120.

[0224] Elements of exemplary embodiment 18 similar to those in exemplary embodiment 1 have the same reference numbers, and the descriptions of those elements are omitted.

[0225] Operations and functions will be described hereinafter. The washer of embodiment 1 individually requires drain pump 33; however, in the washer of embodiment 18, washing pump 28 can function as drain pump 33 since one of feeding/discharging passages 37 communicates with draining passage 69. Rotary water dividing unit 40 in the washer is controlled so that discharge port 41 is not turned to feeding/discharging passages 37 communicating with draining passage 69 in a washing process but water is drained through draining passage 69 only in a draining process. When the washing water leaks from water dividing apparatus 35 to draining passage 69 during washing, a drain open/close valve or a check valve (not shown) is disposed in feeding/discharging passages 37 between water dividing apparatus 35 and draining passage 69. Otherwise, a gap between discharge port 41 and divided water discharge port 44 is sealed. The following operation is also considered. During the washing, the rotary water dividing unit is continuously rotated in a constant direction, and the washing water is not drained out of the washer through the draining passage thanks to the open/close valve. During the draining, the discharge port in the rotary water dividing unit is operated so as to make the washing water flow to the draining passage.

[0226] One of feeding/discharging passages 37 communicates with garbage collecting filter (foreign matter collecting means) 120 for collecting garbage in the washing water. When rotary water dividing unit 40 continuously rotates in one direction, the soiled washing water is intermittently sprayed to garbage collecting filter 120 to collect dirt during washing. By the completion of washing process and the rinsing process, dirt such as the garbage can be mostly collected by garbage collecting filter 120. Spray time for garbage collecting filter 120 can be extended by control of the rotary water dividing unit. The garbage can be certainly collected even in a short washing time. Additionally, the following method can be used: a method of forwardly and reversely rotating rotary water dividing unit 40 so as to prevent the washing water from being fed to feeding/discharging passages 37 for collecting garbage in the final rinsing process; or a method of rotating rotary water dividing unit 40 in one direction and installing the drain open/close valve (not shown) in feeding/discharging passages 37 between water dividing apparatus 35 and garbage collecting filter 120. Thus, the washing water does not flow through the garbage, but only fresh water is used for washing the eating utensils. The garbage is therefore prevented from re-adhering to the eating utensils.

Washed eating utensils are sanitary.

[0227] In embodiment 18, thus, without installing another new feeding/discharging passage, the washing water discharged by a washing water feeding means can be fed to a function means such as garbage collecting filter by accurately controlling washing flow quantity , spray time, and spray timing using a water dividing means. A washing pump is used as a drain pump to downsize a mechanism unit and reduce the cost. Discharge pressure of the washing pump can be used as a driving source for moving a movable unit such as an open/close valve disposed in the function means, without requiring any solenoid valve or the other driving source.

[0228] All elements in the garbage collecting structure and the drain structure do not need to be integrally formed, and each element may be independently formed. In embodiment 18, washing nozzles are disposed at the tops of feeding/discharging passages and one of the feeding/discharging passages is provided with not the washing nozzle but the garbage collecting filter, or the washing pump communicating with the draining passage is used as the drain pump. However, the present invention is not limited to this. As the function means, a detergent throwing apparatus, a detergent dissolving apparatus, a water softener, an ion generating apparatus using acid or alkali, or a clarifying apparatus can be used. When the drying air generated by the blowing means is used as the function means as shown in embodiment 17, for example, the drying air may be used as a driving source for opening or closing a lid of an exhaust port. The drying air is also used as cooling air for dehumidifying and drying, or as drawing-in air for introducing outside air.

INDUSTRIAL APPLICABILITY

[0229] A washer structure of the present invention allows spray of washing water to any objects to be washed from a plurality of directions without increasing fed water. High efficient washing allowing shorter washing can be realized. The number of rinsings is decreased, energy consumption is reduced, and also water consumption is reduced. The objects to be washed can be easily set at setting positions in a rack, and therefore a washer having high setting ability can be obtained.

Claims

1. A washer comprising:

(a) a plurality of washing means for spraying washing water to an object to be washed from various directions, each of said plurality of washing means having a spray port, the washing water being sprayed from the spray port;
(b) washing water feeding means for feeding the washing water to said washing means; and
(c) controlling means for controlling an operation of said washing water feeding means,

wherein the washing water is sequentially fed to each of said plurality of washing means.

2. A washer according to claim 1 further comprising:

(d) a rack for holding the object to be washed;
(e) a washing tub for accommodating said rack, said washing tub having an opening; and
(f) a cover for opening or closing the opening in said washing tub.

3. A washer according to claim 2 further comprising:

(g) a passage for feeding/discharging the water (feeding/discharging passage) for coupling said washing water feeding means with said washing means; and
(h) water dividing means disposed in said feeding passage and having driving means.

4. A washer according to claim 3, wherein
said water dividing means comprises:

(1) an aqueduct for guiding the washing water pressurized by said washing water feeding means;
(2) a divided water output unit having a plurality of divided water discharge ports and said plurality of feeding/discharging passages, each of said feeding/discharging passages being coupled to each of the divided water discharge ports; and
(3) a rotary water dividing unit having a discharge port, wherein the rotary water dividing unit is rotatably disposed at a position facing the divided water output unit and is rotated by the driving means, and the discharge port discharges the washing water fed from the aqueduct,

each of said washing means is coupled to each of said feeding/discharging passages,
the discharge port and the plurality of divided water discharge ports are arranged so that, during the rotation of the rotary water dividing unit, the discharge port sequentially faces the respective divided water discharge ports to feed the washing water discharged from the discharge port sequentially to said respective passages, and
the washing water pressurized by said washing water feeding means flows through the aqueduct, is discharged from the discharge port in the rotating rotary water dividing unit, is fed sequentially to each of said plurality of feeding/discharging pas-

sages, is guided to each of said washing means, and is sprayed from each of said washing means.

5. A washer according to claim 4, wherein
the discharge port comprises a plurality of discharge ports,
the rotary water dividing unit has a substantially cylindrical surface,
the plurality of discharge ports are formed in any part of the substantially cylindrical surface, and
the washing water discharged from the plurality of discharge ports is sprayed simultaneously from at least two of said plurality of washing means, and the washing water is sprayed sequentially by said washing means one after another.

6. A washer according to claim 4, wherein
the driving means has a function of setting any rotation speed of the rotary water dividing unit, and
the rotary water dividing unit rotates at the set rotation speed.

7. A washer according to claim 4, wherein
the driving means has rotation angle detecting means for detecting a rotation angle of the rotary water dividing unit.

8. A washer according to claim 4, wherein
the driving means forwardly and reversely rotates the rotary water dividing unit.

9. A washer according to claim 4, wherein
the discharge port comprises a plurality of discharge ports,
the rotary water dividing unit has a substantially cylindrical surface, and
the plurality of discharge ports are formed in the substantially cylindrical surface of the rotary water dividing unit so that respective rotation tracks of the plurality of discharge ports are different from each other.

10. A washer according to claim 4, wherein
the discharge port comprises a plurality of discharge ports,
the plurality of discharge ports are formed in the rotary water dividing unit, and
at least one of the plurality of discharge ports is formed in a surface substantially vertical to a rotating shaft of the rotary water dividing unit.

11. A washer according to claim 4, wherein
the rotary water dividing unit has a rotating shaft, and
the rotating shaft is disposed substantially horizontally.

12. A washer according to claim 4, wherein
said washing water feeding means comprises a washing pump having a washing pump discharge port,
the driving means has a driving shaft,
the driving shaft is disposed in a substantially identical direction to a flow direction of the washing water discharged from said washing water feeding means, and
the driving means is disposed on an opposite side against the washing pump discharge port with respect to the rotary water dividing unit.

13. A washer according to claim 4, wherein
the divided water output unit has a divided water discharge port,
said washing water feeding means has a washing pump discharge port, and
the divided water discharge port is formed at a position higher than the washing pump discharge port.

14. A washer according to claim 4, wherein
the rotary water dividing unit has at least one curved surface of a conical surface and a cylindrical surface having a rotating axis, and
the discharge port is formed in the curved surface.

15. A washer according to claim 3, wherein
said water dividing means comprises:

(1) an aqueduct for guiding the washing water pressurized by said washing water feeding means;
(2) a divided water output unit having a plurality of divided water discharge ports and said plurality of feeding/discharging passages, each of said feeding/discharging passages being coupled to each of the divided water discharge ports; and
(3) a changeover unit for switching a flow passage of the washing water fed from the aqueduct, wherein the changeover unit has a rotary water dividing unit having a discharge port, the rotary water dividing unit is rotatably disposed at a position facing the divided water output unit and is rotated by the driving means, and the discharge port discharges the washing water guided from the aqueduct,

a cross section area of at least a first divided water discharge port of the plurality of divided water discharge ports and a passage cross section area of a first feeding/discharging passage communicating with the first divided water discharge port are larger than an opening area of the discharge port, respectively,
the discharge port and the plurality of divided

water discharge ports are formed so that, during rotation of the rotary water dividing unit, the discharge port sequentially faces the respective divided water discharge ports to feed the washing water discharged from the discharge port sequentially to the respective divided water discharge ports, and

the washing water pressurized by said washing water feeding means flows through the aqueduct, is discharged from the discharge port in the rotating rotary water dividing unit, is fed sequentially to each of said plurality of feeding/discharging passages, is guided to each of said washing means, and is sprayed from each of said washing means.

16. A washer according to claim 15,

wherein the opening of the first divided water discharge port has a rectangular or substantially elliptical shape circumferentially longer than a shape of the opening of the discharge port.

17. A washer according to claim 16,

wherein the first feeding/discharging passage is formed of a passage for changing the cross section area of the first divided water discharge port to a passage cross section area of a second feeding/discharging passage and a passage having a cross section area substantially identical to a passage cross section area of a second divided water discharge port.

18. A washer according to claim 4, wherein

the rotary water dividing unit has the plurality of divided water discharge ports, and

a circumferential direction length of the discharge port is substantially equal to or longer than a circular arc length between respective openings of adjacent divided water discharge ports.

19. A washer according to claim 4, wherein

the rotary water dividing unit has the plurality of divided water discharge ports, and

a circumferential length of the discharge port is substantially equal to or longer than a sum of a circular arc length of the divided water discharge port lying at any position and a circular arc length between respective openings of adjacent divided water discharge ports.

20. A washer according to claim 3, wherein

said water dividing means comprises:

(1) an aqueduct for guiding the washing water pressurized by said washing water feeding means;

(2) a divided water output unit having a plurality of divided water discharge ports and said plurality of feeding/discharging passages, each of said feeding/discharging passages being coupled to each of the divided water discharge ports; and

(3) a changeover unit for switching a flow passage of the washing water fed from the aqueduct, wherein the changeover unit has a rotary water dividing unit having a plurality of discharge ports, the rotary water dividing unit is rotatably disposed at a position facing the divided water output unit and is rotated by the driving means, and the plurality of discharge ports discharge the washing water guided from the aqueduct,

the rotary water dividing unit and the divided water output unit are disposed so as to prevent all of the plurality of discharge ports from simultaneously communicating with the plurality of divided water discharge ports during an changeover operation of the changeover unit,

the discharge ports sequentially face the respective divided water discharge ports to feed the washing water discharged from the discharge ports sequentially to the respective divided water discharge ports when the rotary water dividing unit rotates, and

the washing water pressurized by said washing water feeding means flows through the aqueduct, is discharged from the discharge port in the rotating rotary water dividing unit, is fed sequentially to each of said plurality of feeding/discharging passages, is guided to each of said washing means, and is sprayed from each of said washing means.

21. A washer according to claim 20,

wherein an opening of at least one of the plurality of discharge ports has a rectangular or substantially elliptical shape circumferentially longer than shapes of the openings of the other discharge ports.

22. A washer according to claim 20,

wherein the plurality of discharge ports and the plurality of divided water discharge ports are formed in the rotary water dividing unit and the divided water output unit, respectively, so that the washing water is always discharged from one of said plurality of washing means.

23. A washer according to claim 20, wherein

an opening of at least a first divided water discharge port of the plurality of divided water discharge ports has a rectangular or substantially elliptical shape circumferentially longer than shapes of the openings of the other divided water discharge ports, and

a first feeding/discharging passage communicating with the first divided water discharge port has a cross section area larger than cross section areas

of the other feeding/discharging passages.

24. A washer according to claim 20,
wherein the divided water output unit has ones of the plurality of divided water discharge ports and passage varying means for varying passage cross sections of said feeding/discharging passages.

25. A washer according to claim 2 or claim 4,
wherein said controlling means controls an operating method so as to spray the washing water from any one of said plurality of washing means.

26. A washer according to claim 25, wherein
said water dividing means has rotational position detecting means, and
said controlling means controls the operating method so as to spray the washing water from one of a substantially upper part and a substantially side part of said washing tub in closing of at least any rinsing process of a washing process.

27. A washer according to claim 25, wherein
said water dividing means has a function of controlling a feeding time of the washing water to each of said washing means, and
said controlling means controls the operating method for spraying so that a spray time of each of said washing means is set to a predetermined time.

28. A washer according to claim 25,
wherein said controlling means controls the operating method so that a first spray time of each of said washing means in a primary washing process is longer than a second spray time of each of said washing means in a rinsing process.

29. A washer according to claim 25, wherein
said water dividing means feeds the washing water to a specific washing means of said plurality of washing means, and
said controlling means controls the operating method so that the washing water is selectively sprayed to the object to be washed accommodated in a partial region of said rack.

30. A washer according to claim 25, wherein
said rack comprises a plurality of racks,
the object to be washed comprises a plurality of eating utensils having a substantially similar shape, and
the plurality of eating utensils are placed in the plurality of racks.

31. A washer according to claim 29,
wherein said controlling means controls an operating method in any washing process so that the washing water is sequentially sprayed from all of said plurality of washing means.

32. A washer according to claim 30,
wherein said controlling means controls an operating method in any washing process so that the washing water is sequentially sprayed from all of said plurality of washing means.

33. A washer according to claim 3 further comprising
(g) function means,
wherein at least one of said feeding/discharging passages communicates with said function means other than said plurality of washing means.

34. A washer according to claim 4 further comprising
(g) a draining passage for draining the washing water out of said washing tub,
wherein one of said plurality of feeding/discharging passages communicates with said draining passage.

35. A washer according to claim 33,
wherein said function means has foreign matter collecting means for collecting a foreign matter in the washing water.

36. A washer according to claim 2,
wherein at least one of said plurality of washing means sprays the washing water while turning.

37. A washer according to claim 2,
wherein said washing water feeding means is vertically disposed.

38. A washer according to claim 2 or claim 4 further comprising
(i) blowing means for feeding air,
wherein said blowing means has a fan and an open/close valve,
the open/close valve has a function of switching between the washing water and the air, and
the air is sequentially fed from said plurality of washing means after switching of the open/close valve.

39. A washer according to claim 38, wherein
said washing water feeding means has a pump,
the pump has both a function of feeding the washing water and a function of feeding wind, and
the pump feeds the wind after switching of the open/close valve.

40. A washer according to claim 2 further comprising
(h) water dividing means disposed between said washing water feeding means and said plurality of washing means,

wherein said water dividing means includes a rotary water dividing unit having a discharge port and a divided water output unit having a plurality of divided water discharge ports,

each of said plurality of washing means communicates with each of the divided water discharge ports,

the divided water output unit is engaged with the rotary water dividing unit so that the discharge port sequentially faces to and communicates with each of the divided water discharge ports when the rotary water dividing unit rotates, and

the washing water fed from said washing water feeding means is discharged from the discharge port in the rotating rotary water dividing unit, sequentially fed to each of the divided water discharge ports, guided to each of said washing means, and sprayed from each of said washing means.

41. A washer according to claim 4,

wherein the driving means controls the rotary water dividing unit so as to face an opening of the discharge port to openings of the divided water discharge ports in a process of feeding the washing water to said washing tub.

42. A washer according to claim 4,

wherein the driving means rotates the rotary water dividing unit in a process of feeding the washing water to said washing tub.

43. A washer according to claim 4,

wherein the driving means controls the rotary water dividing unit so as to face an opening of the discharge port to openings of the divided water discharge ports in a process of draining the washing water.

44. A washer according to claim 4,

wherein the driving means rotates the rotary water dividing unit in a process of draining the washing water.

FIG. 1

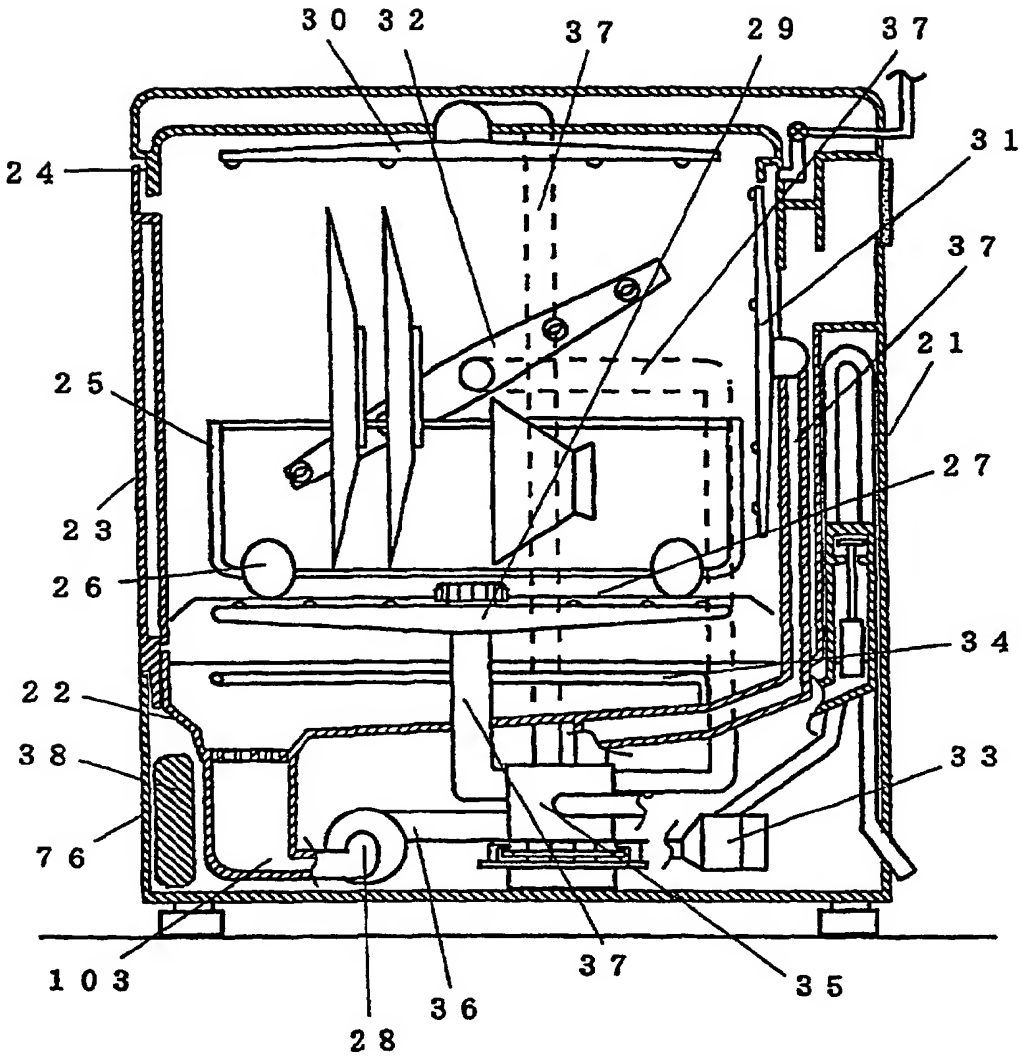


FIG. 2

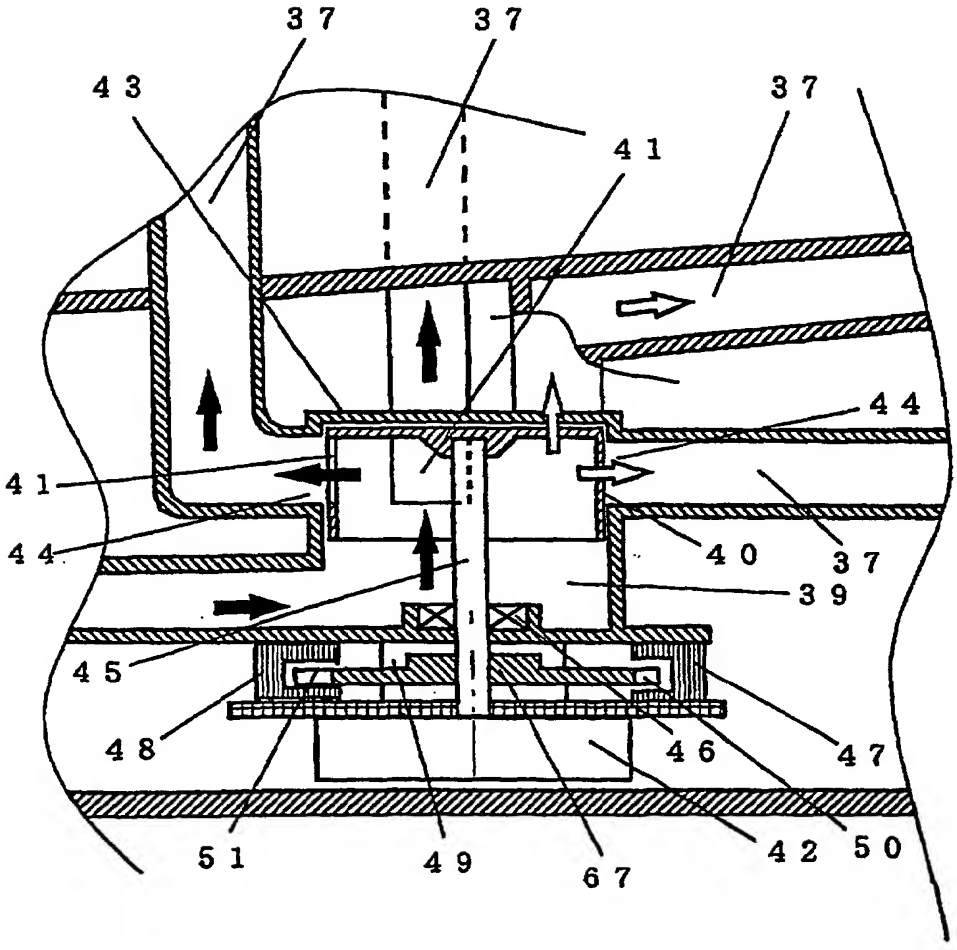


FIG. 3

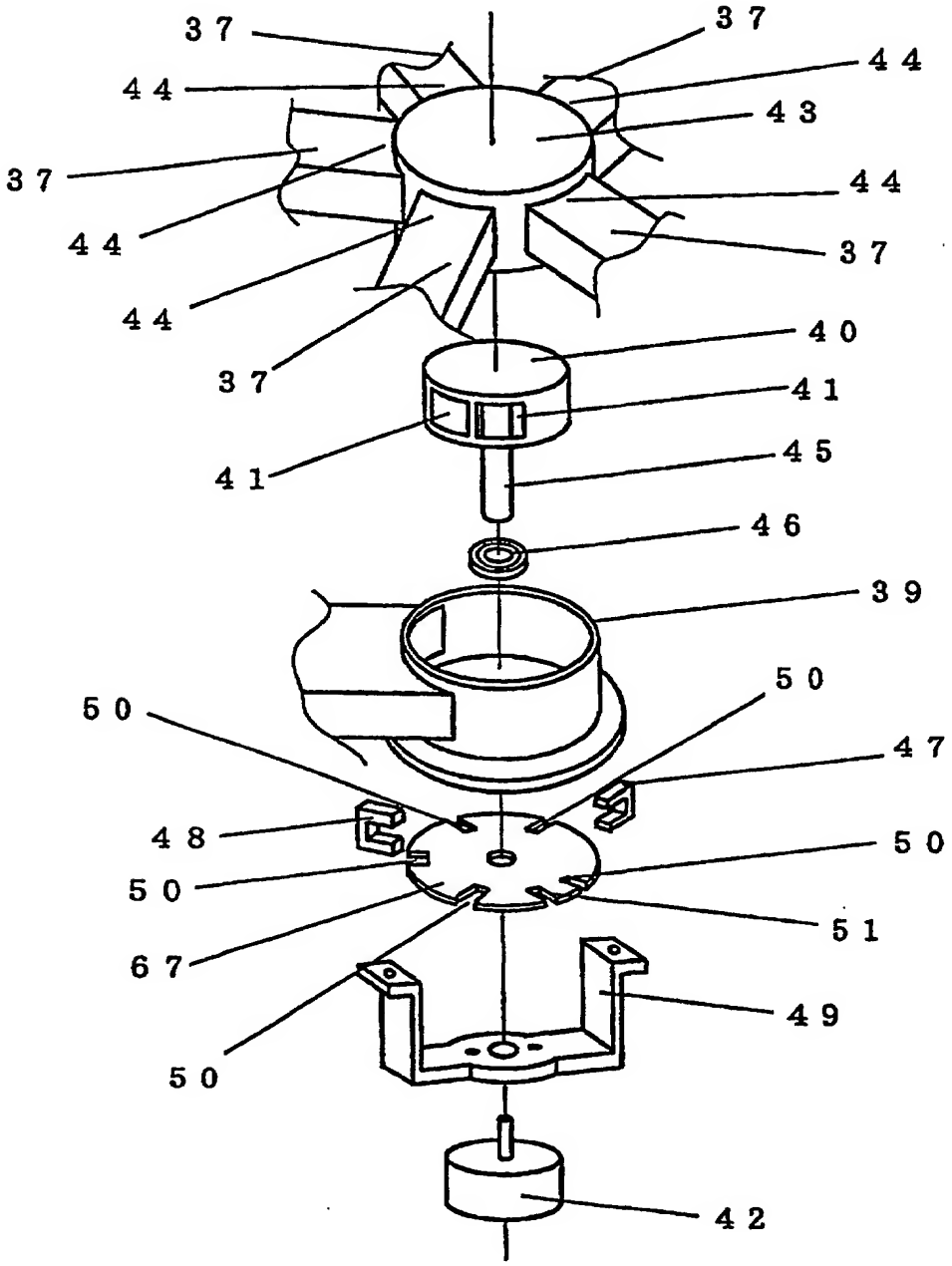

37
37
44
44
43
37
44
44
37
44
37
40
41
41
45
46
39
50
50
47
48
50
50
51
67
49
50
42

FIG. 4

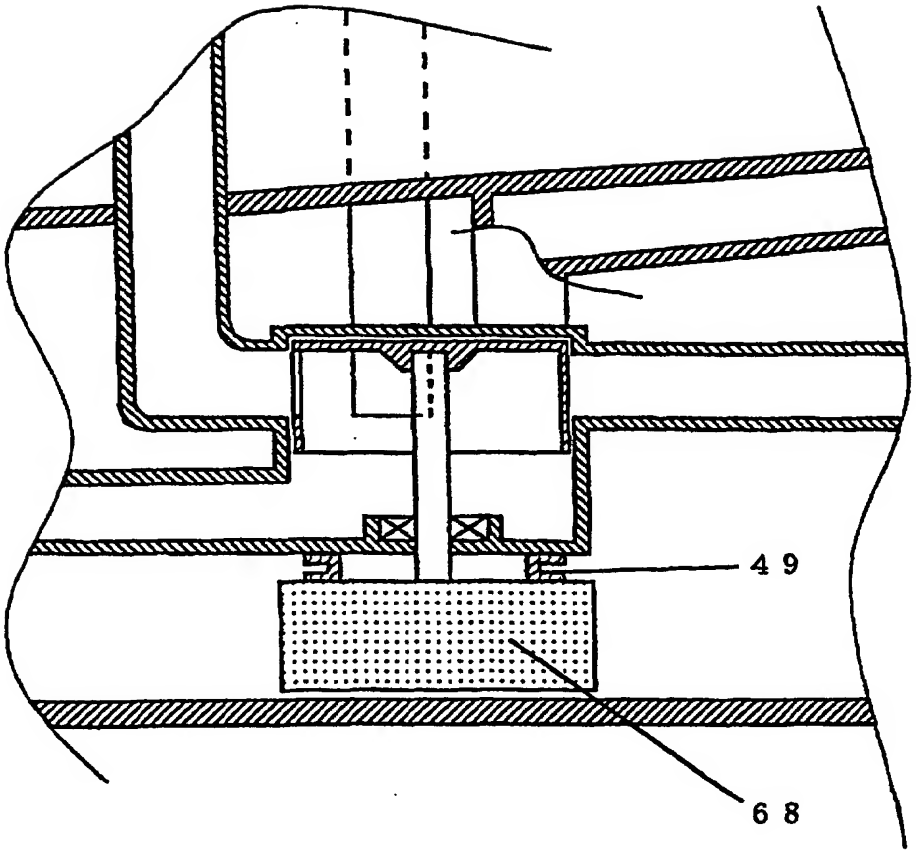


FIG. 5

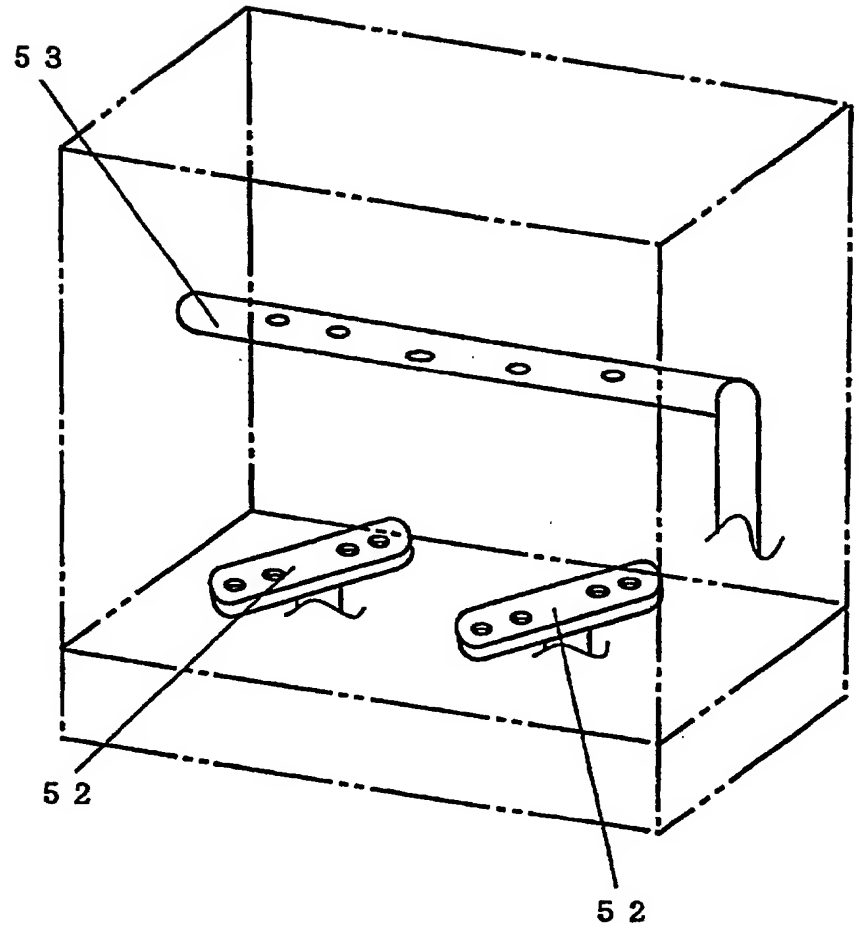


FIG. 6

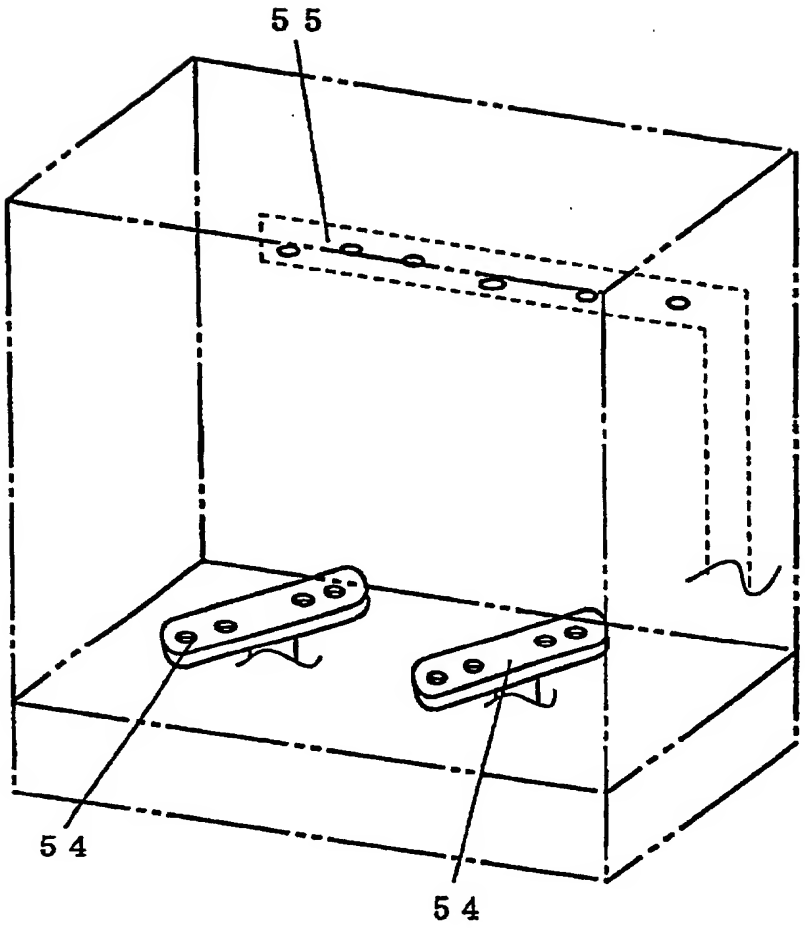


FIG. 7

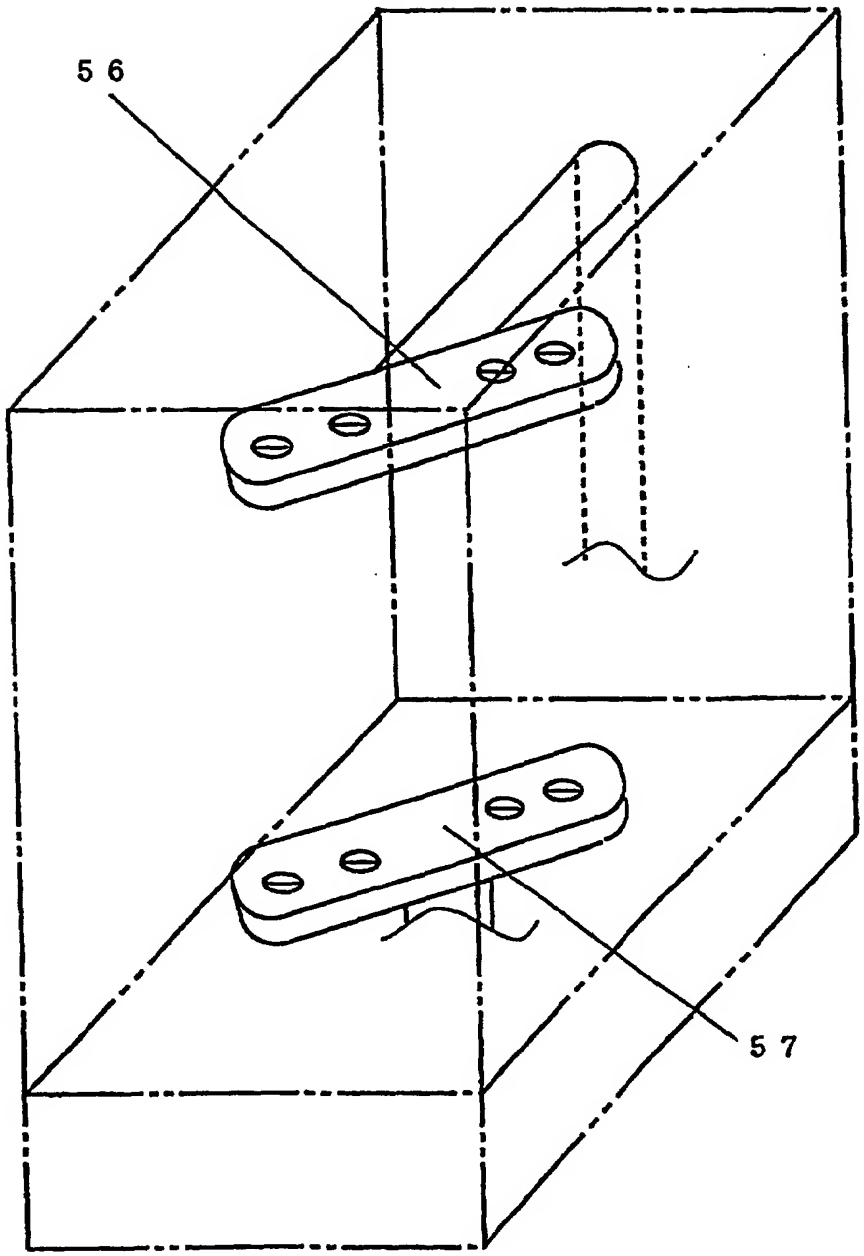


FIG. 8

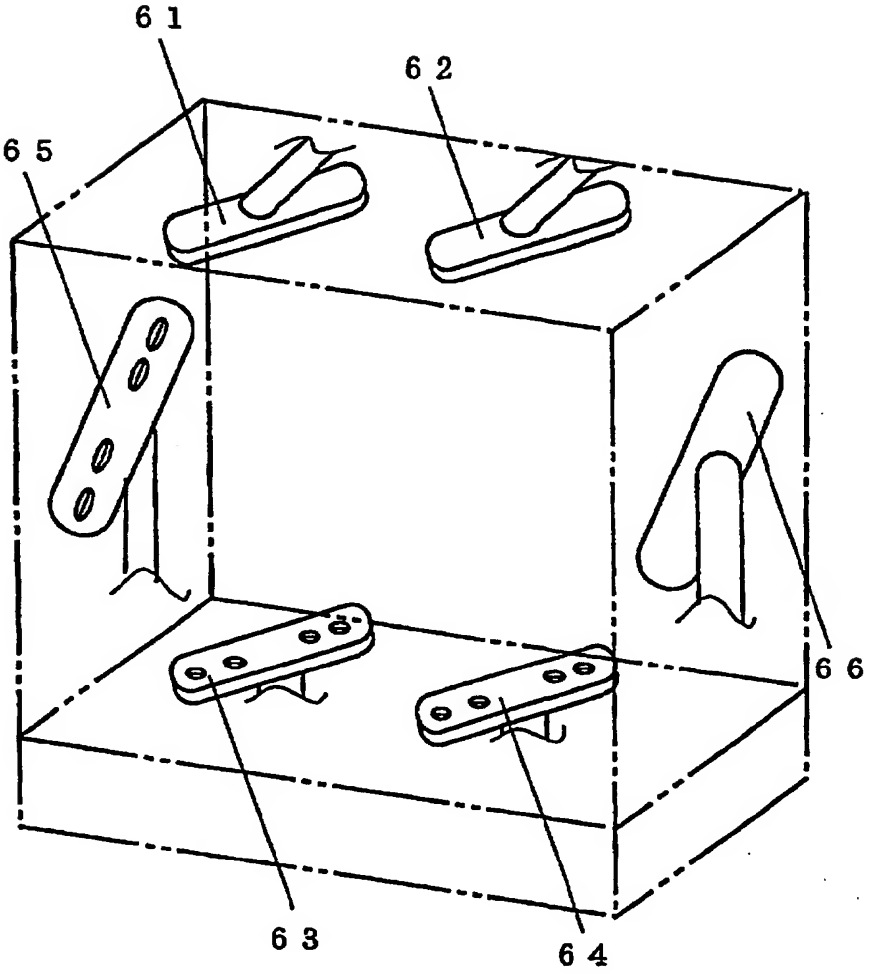


FIG. 9

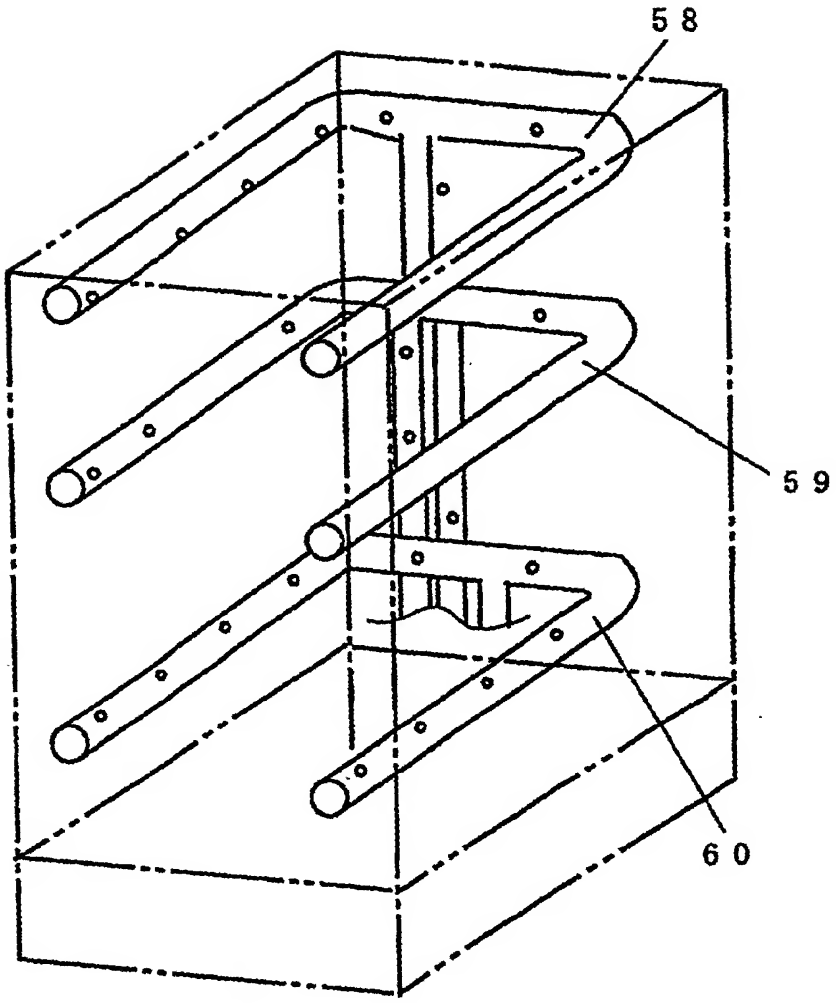


FIG. 10

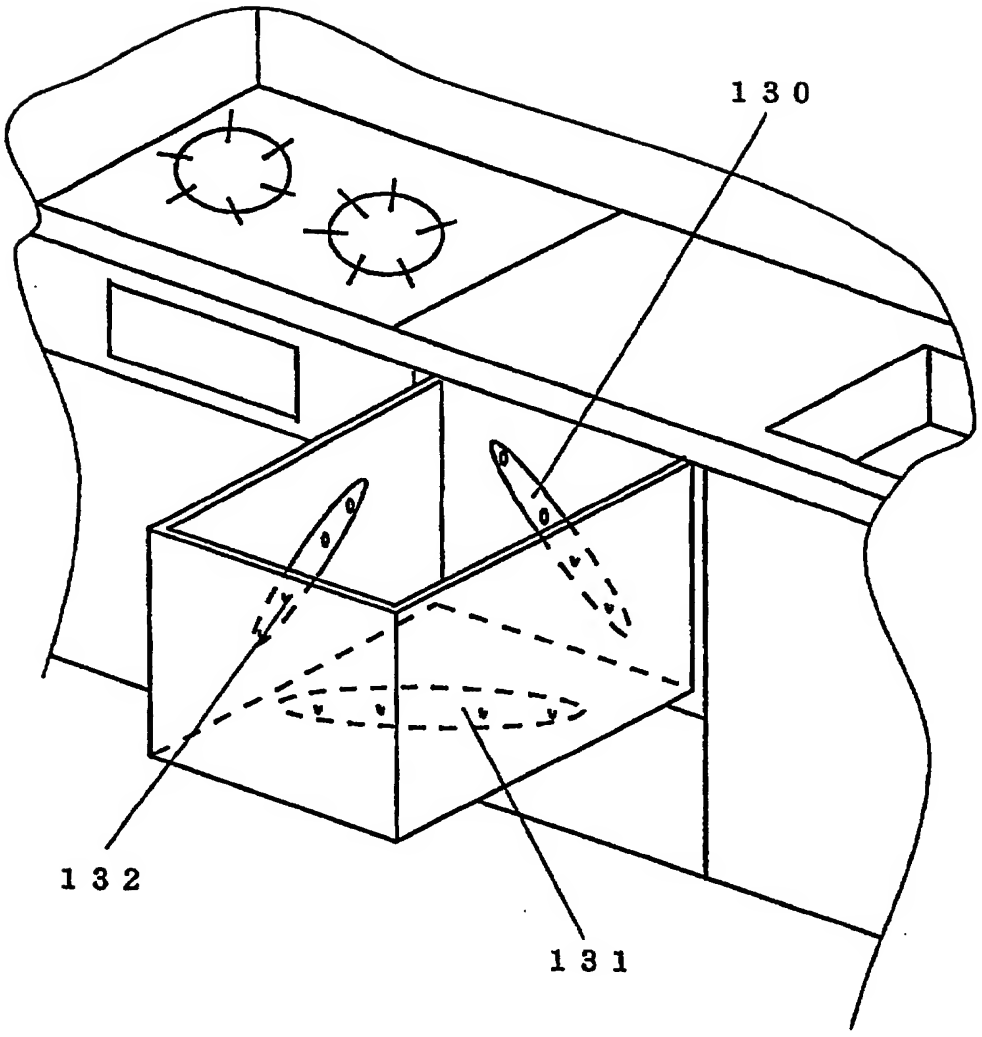


FIG. 11

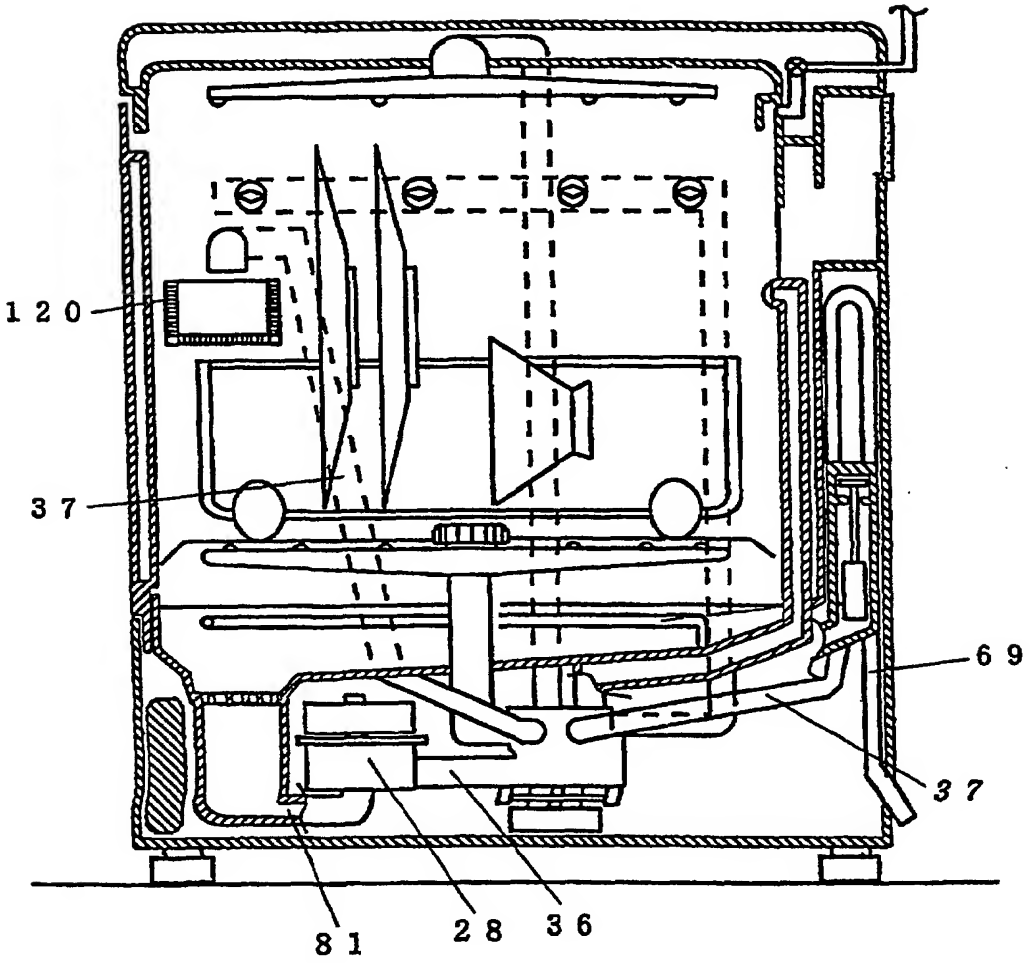


FIG. 12

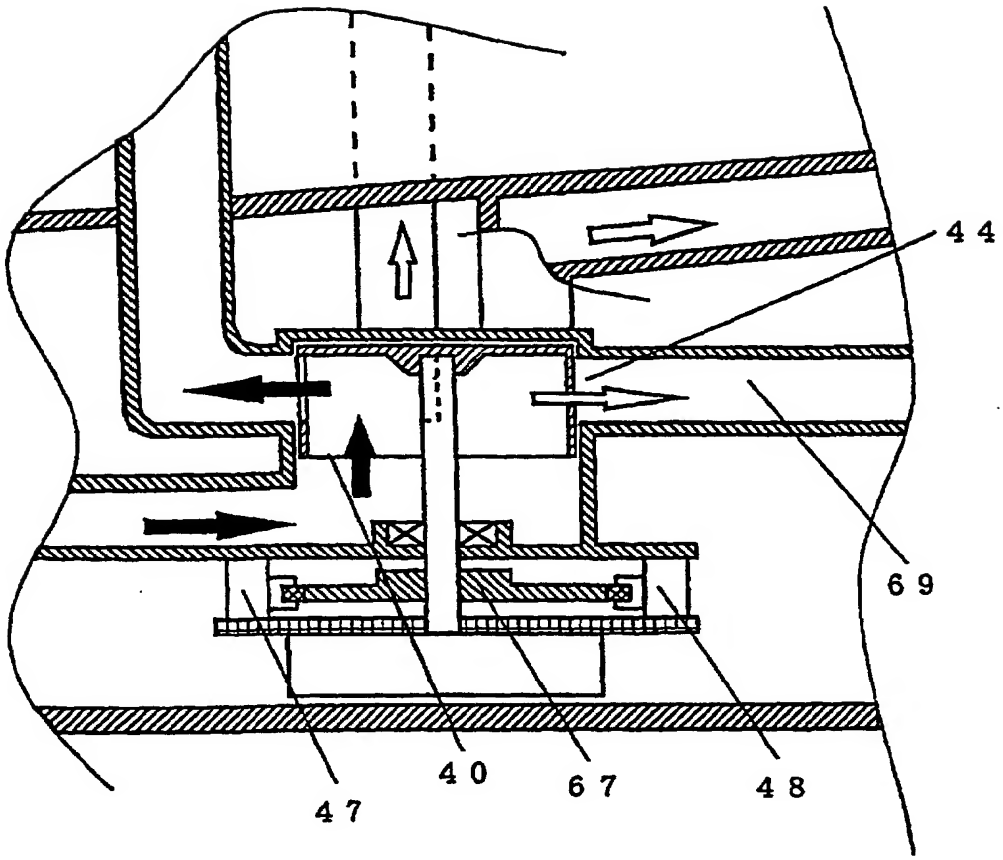


FIG. 13

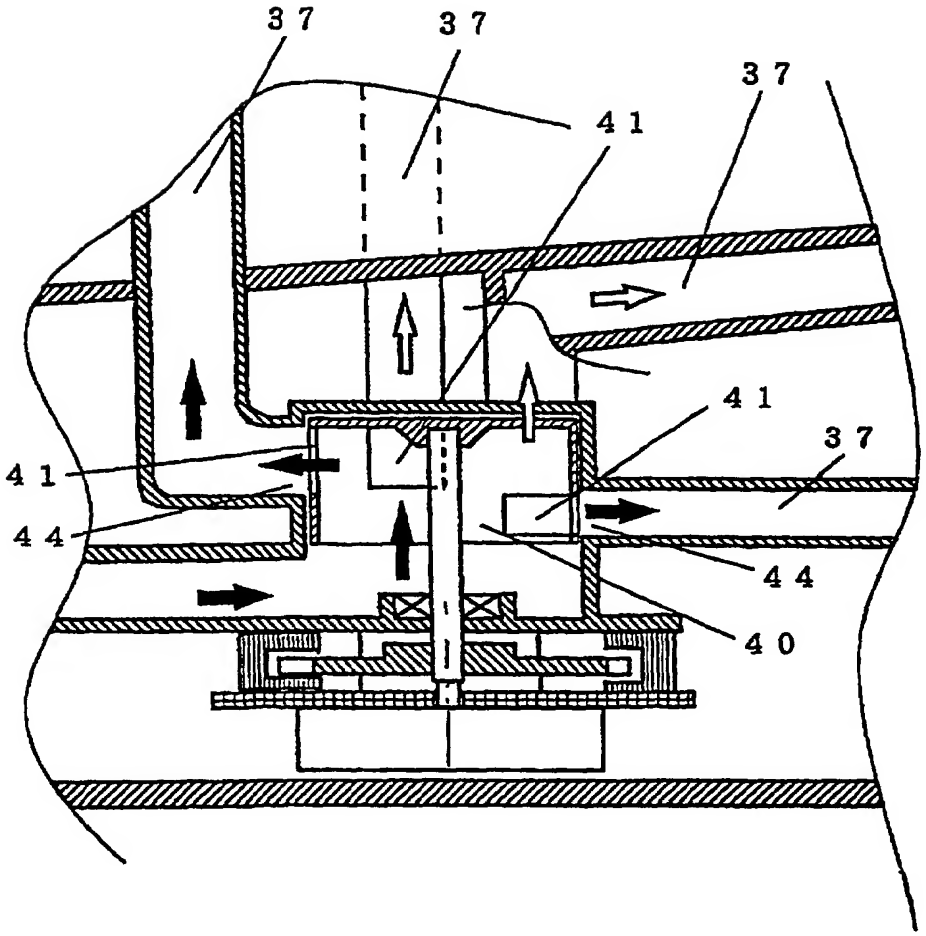


FIG. 14

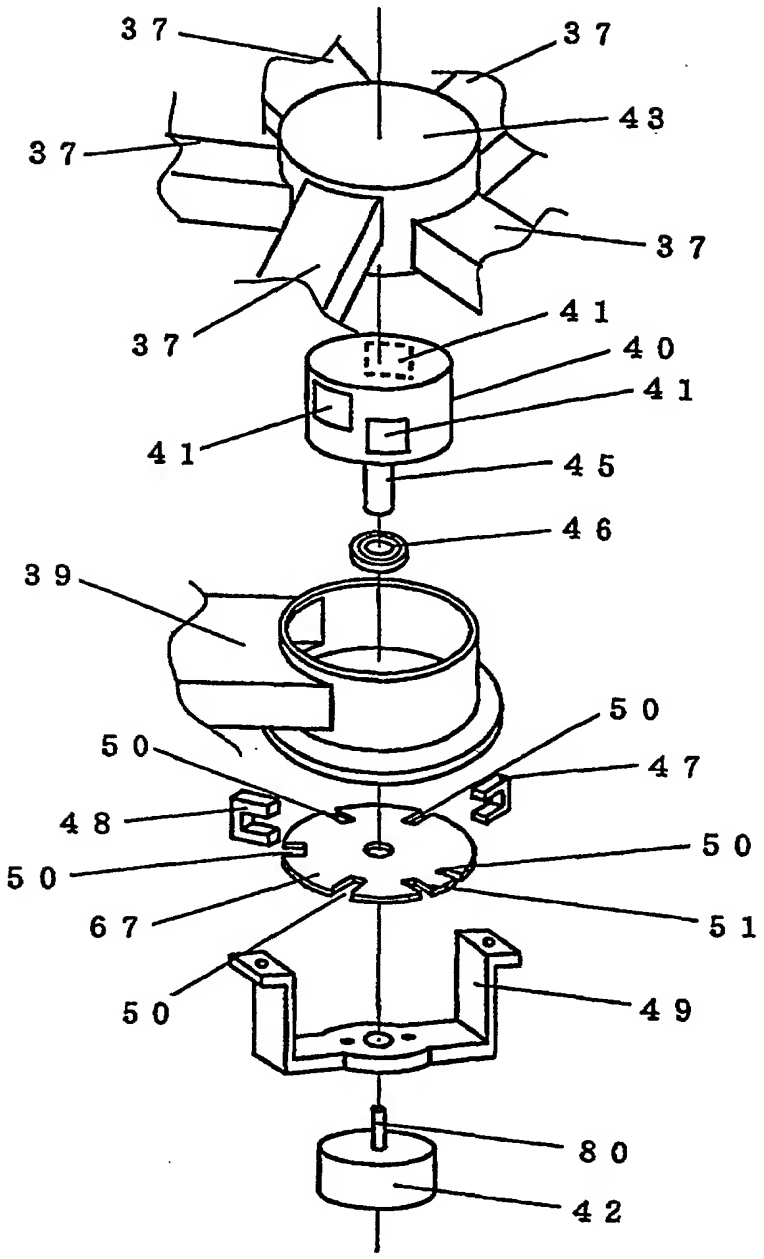

37
37
37
43
37
37
41
37
40
41
41
45
46
39
50
50
47
48
50
50
67
51
50
49
80
42

FIG. 15

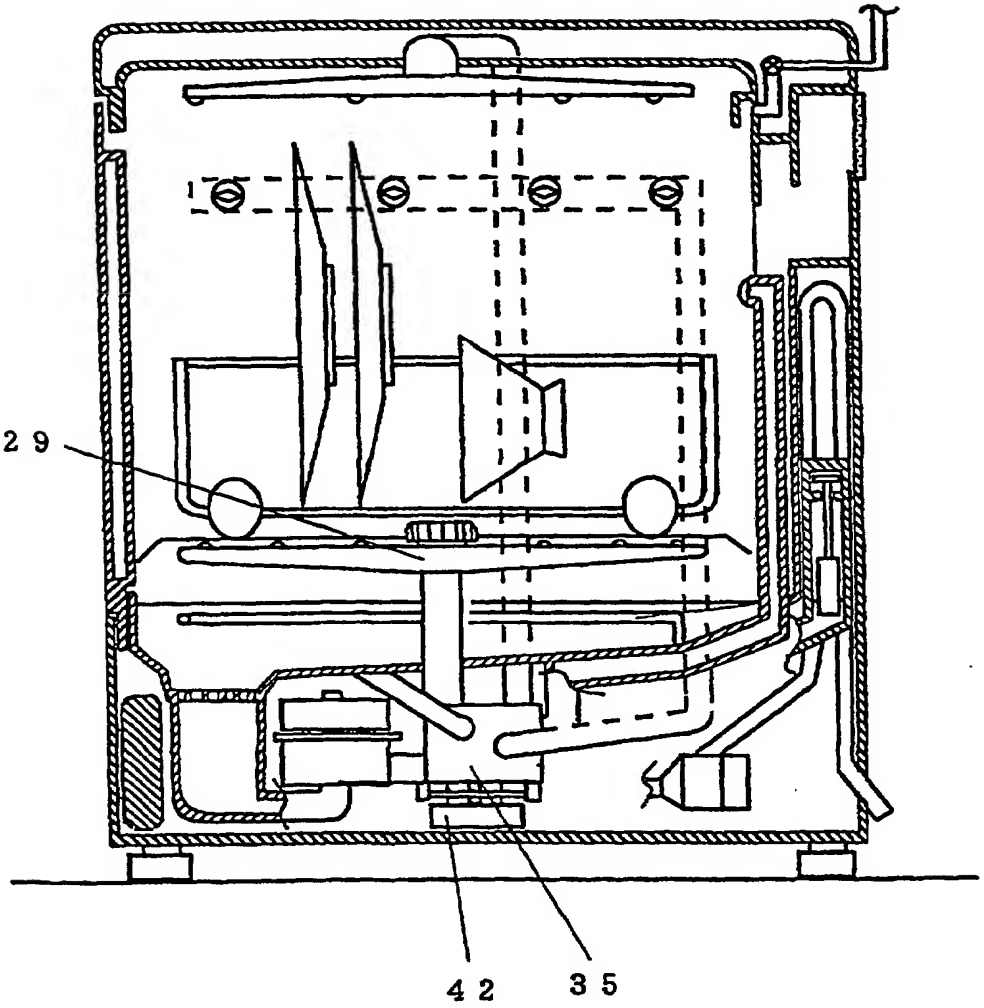


FIG. 16

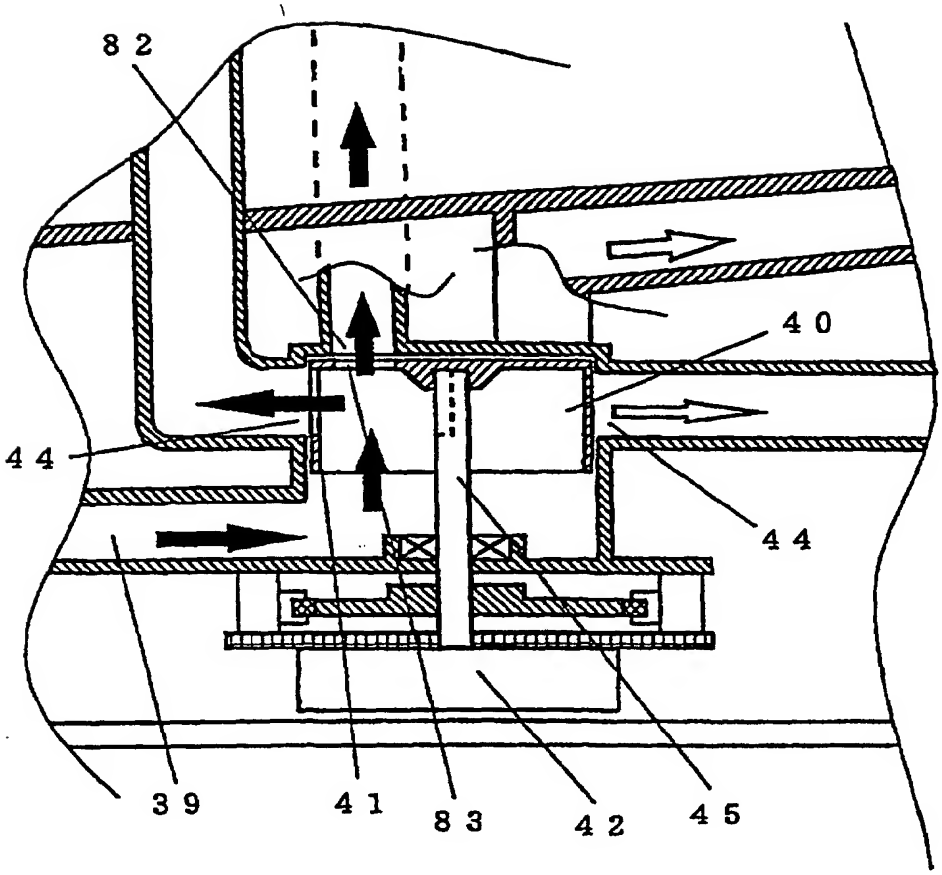


FIG. 17

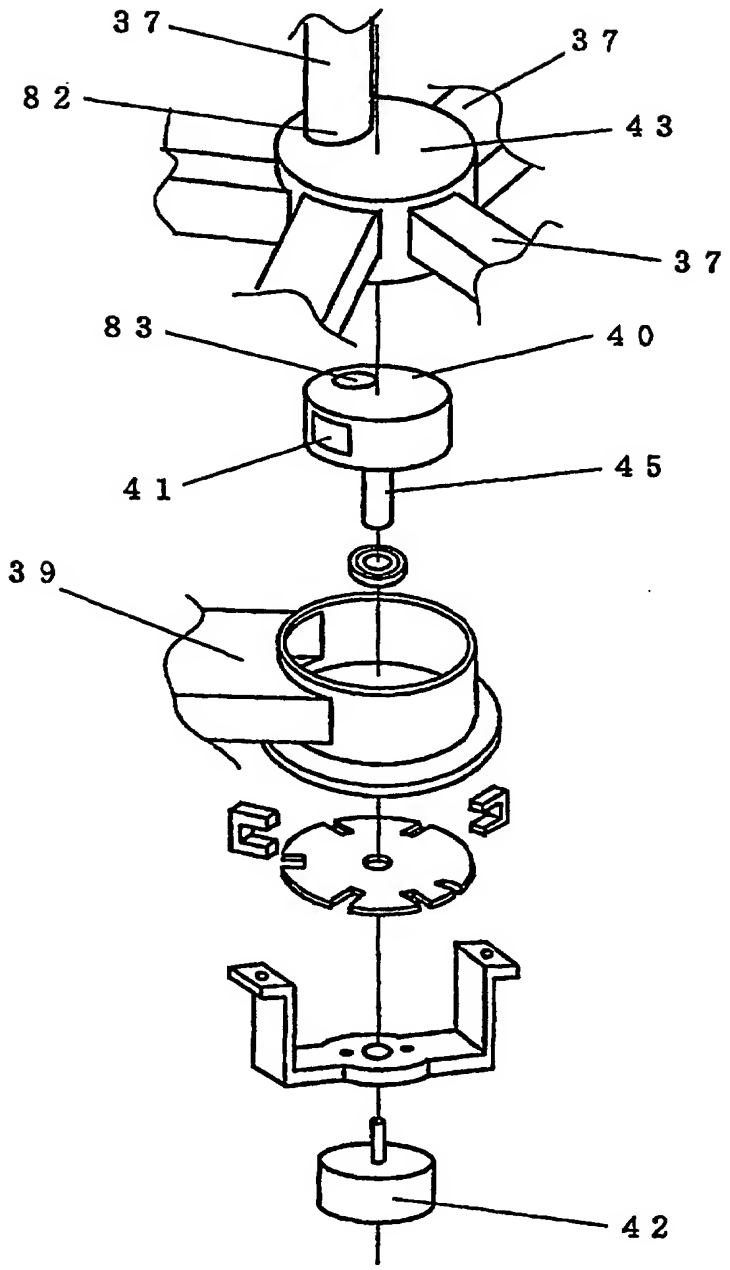


FIG. 18

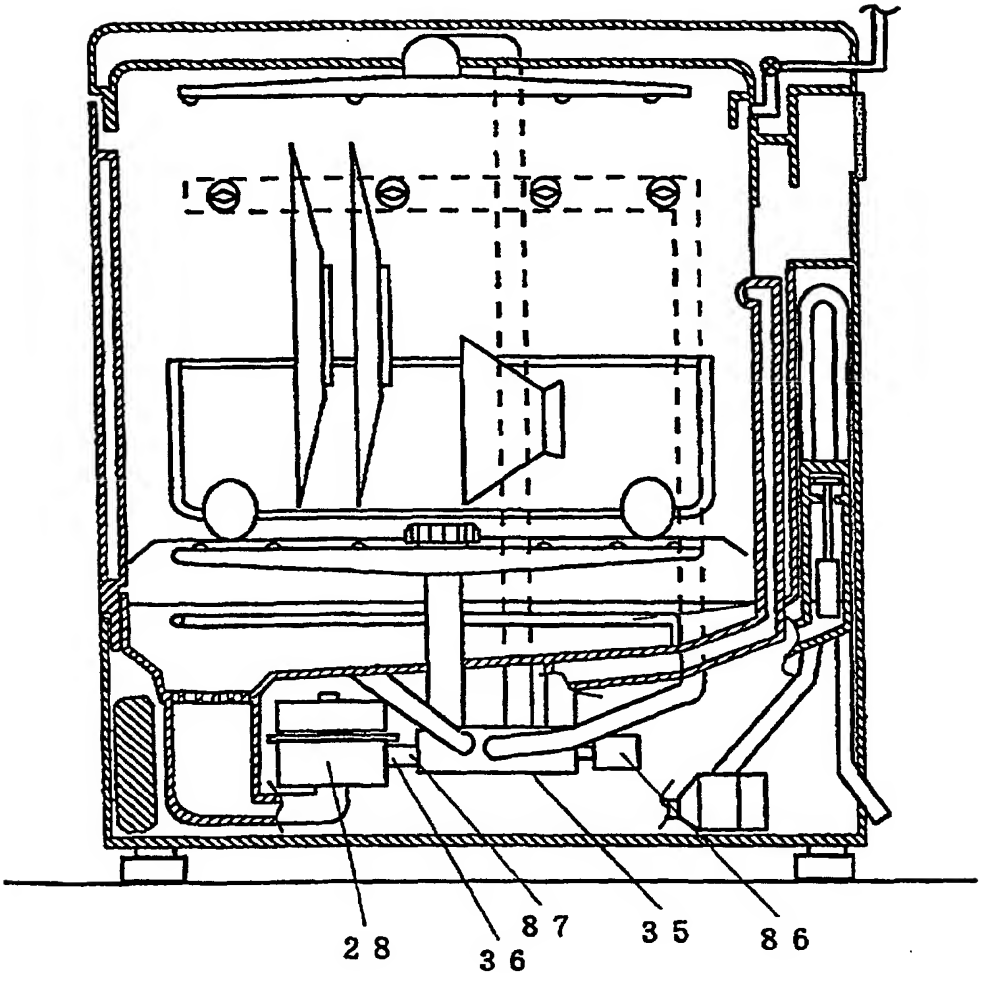


FIG. 19

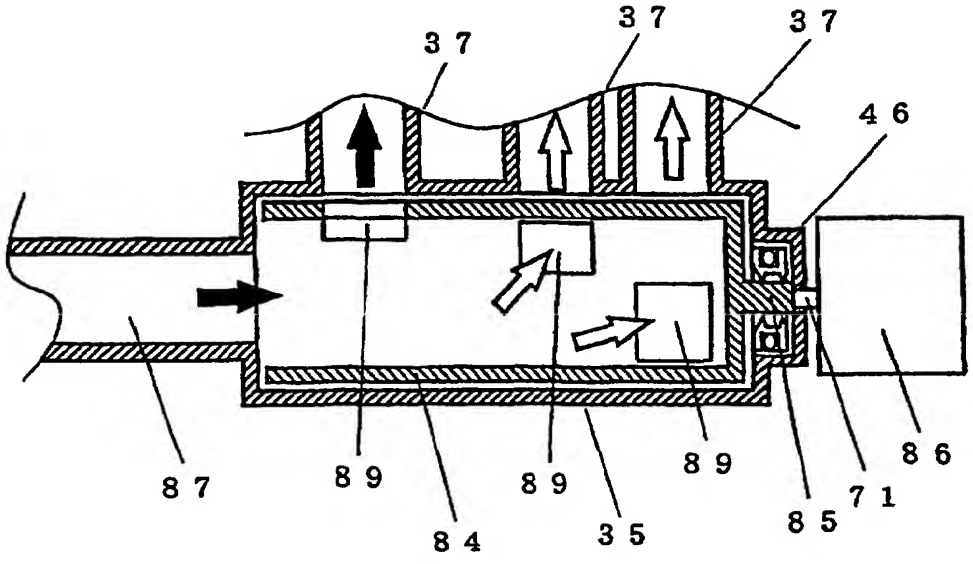


FIG. 20

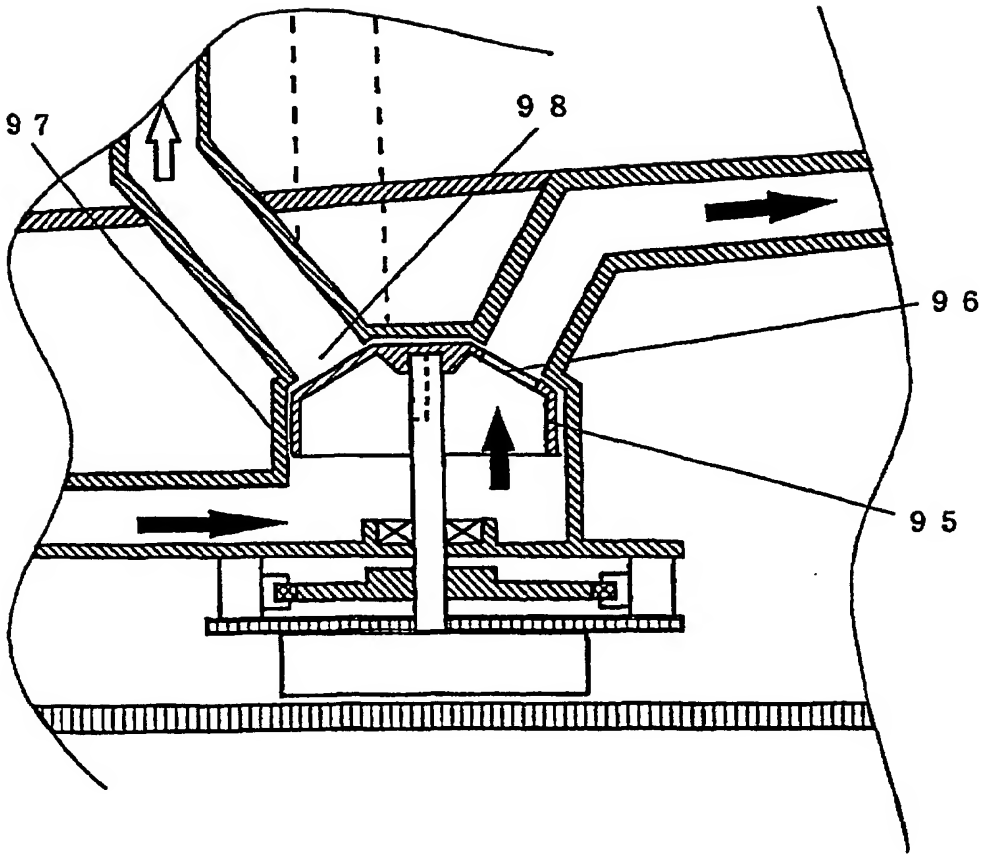


FIG. 21

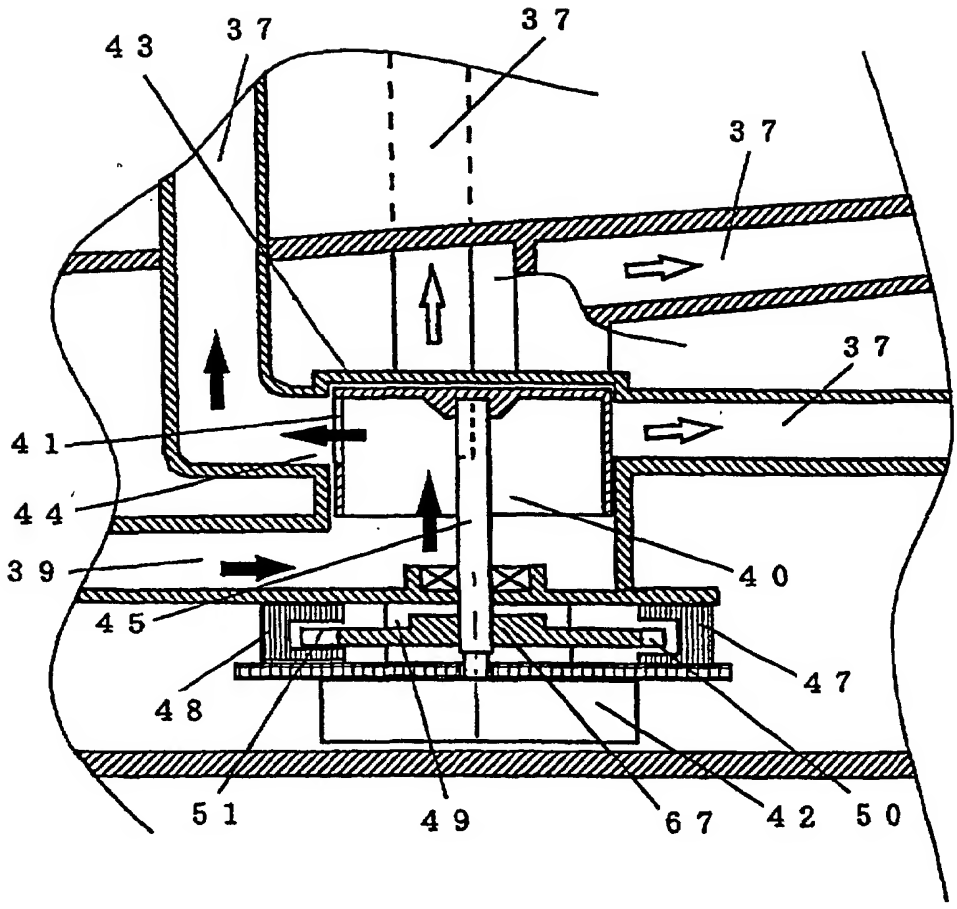


FIG. 22

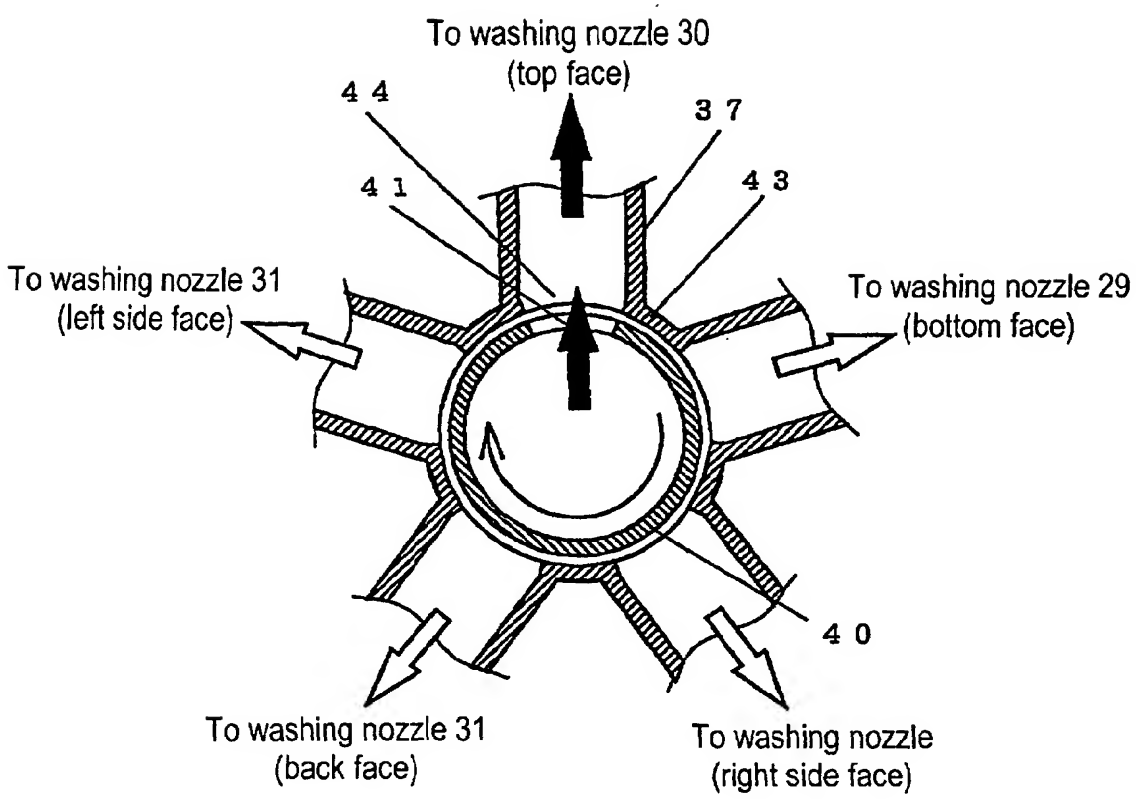

To washing nozzle 30
(top face)
44
37
41
43
To washing nozzle 31
(left side face)
To washing nozzle 29
(bottom face)
40
To washing nozzle 31
(back face)
To washing nozzle
(right side face)

FIG. 23

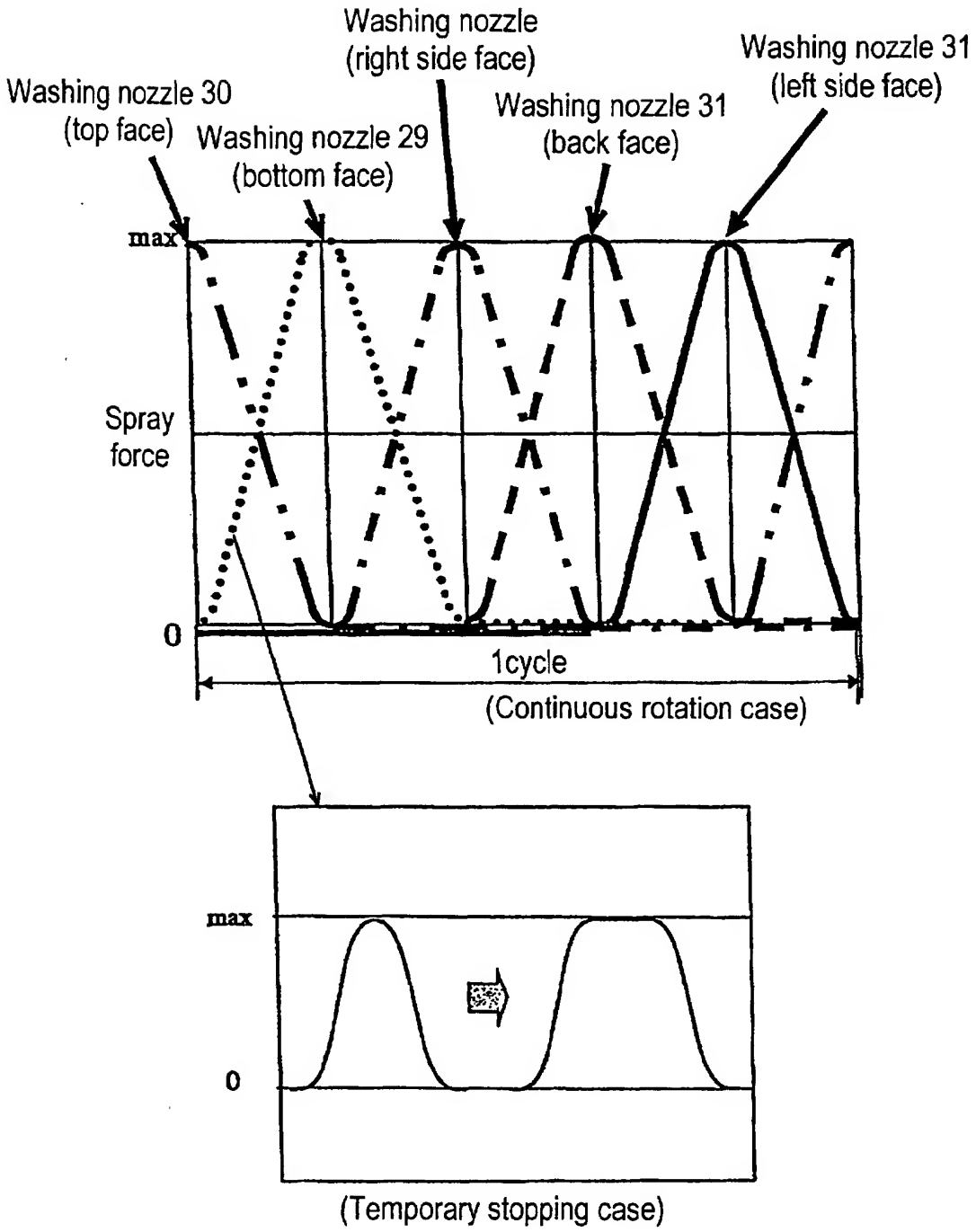

Washing nozzle
(right side face)
Washing nozzle 31
(left side face)
Washing nozzle 30
(top face)
Washing nozzle 29
(bottom face)
Washing nozzle 31
(back face)
max
Spray
force
0
1cycle
(Continuous rotation case)
max
0
(Temporary stopping case)

FIG. 24

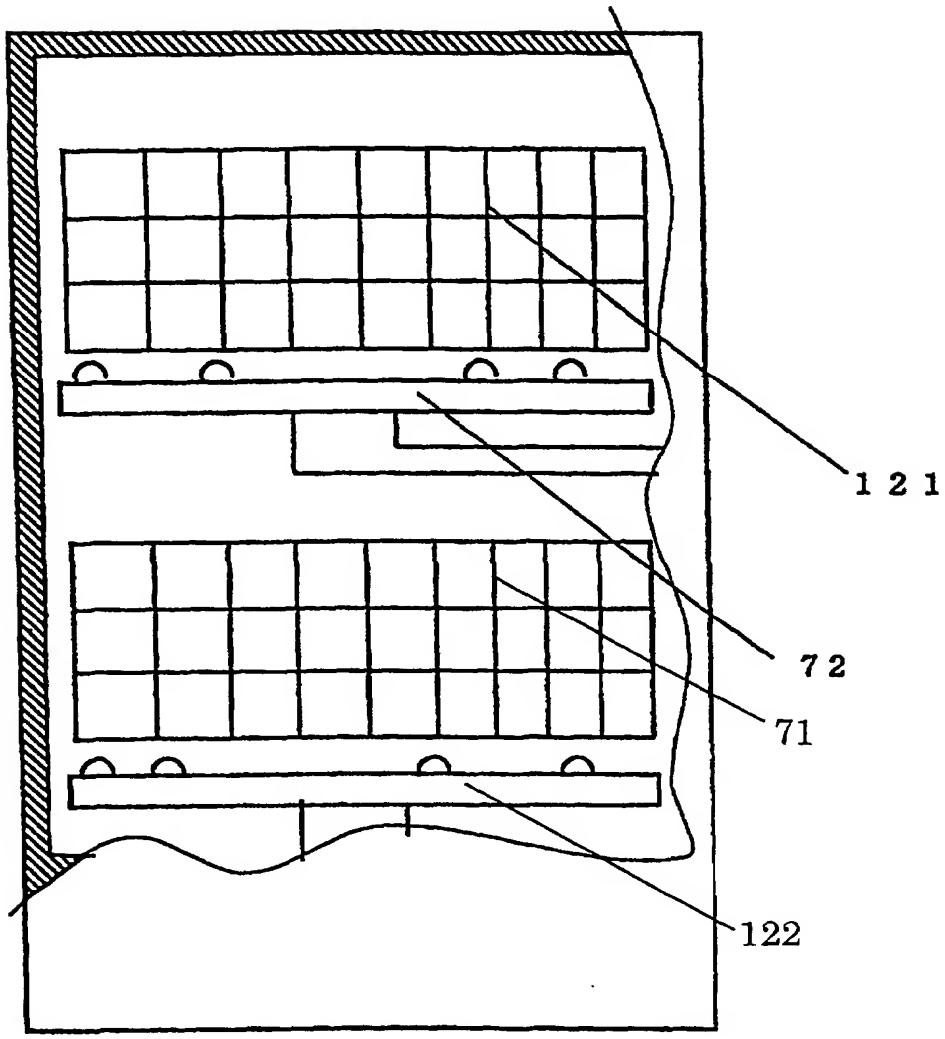


FIG. 25

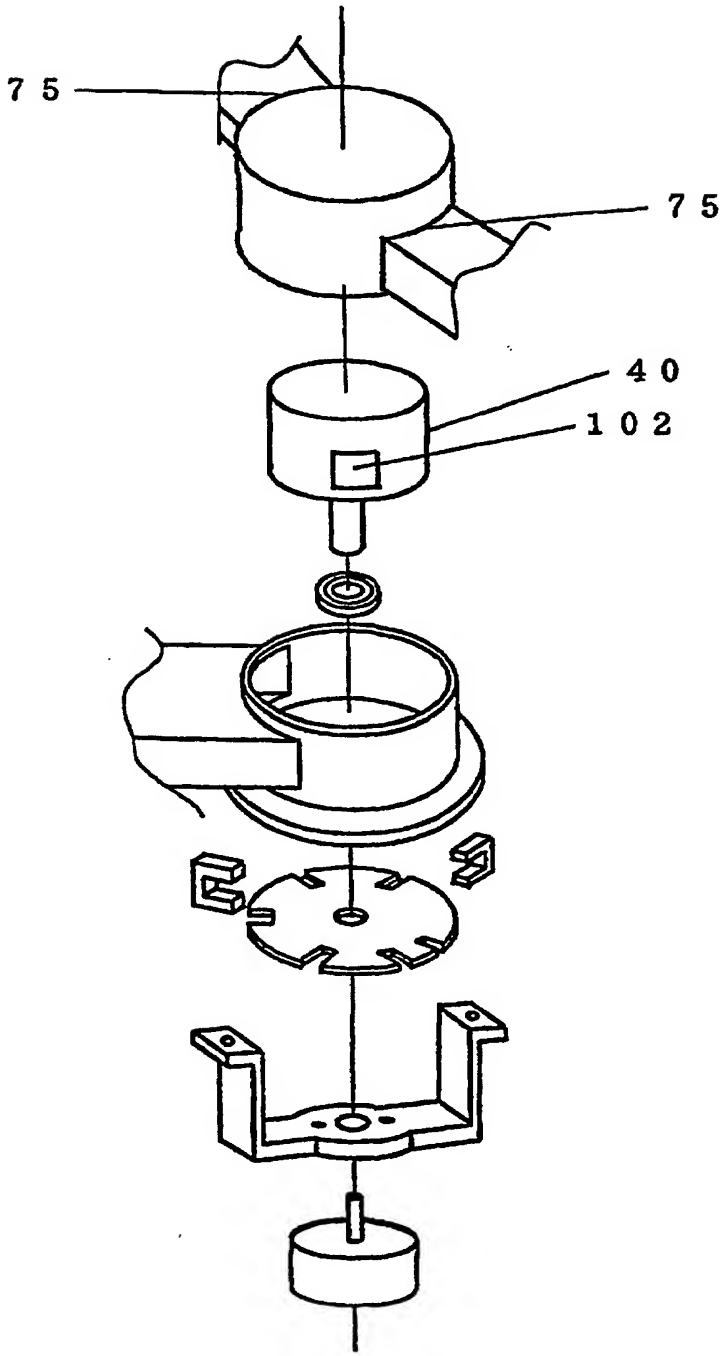


FIG. 26

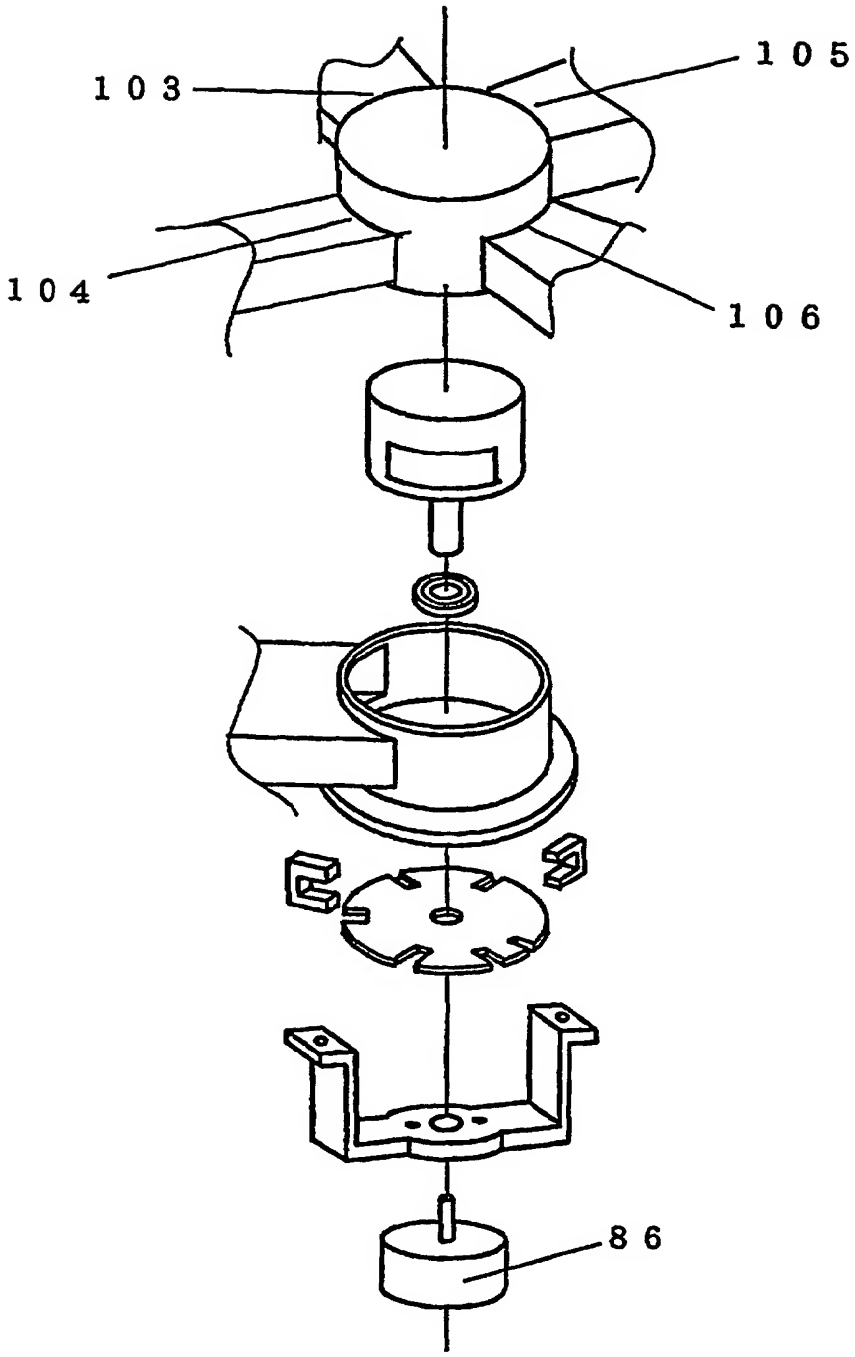


FIG. 27

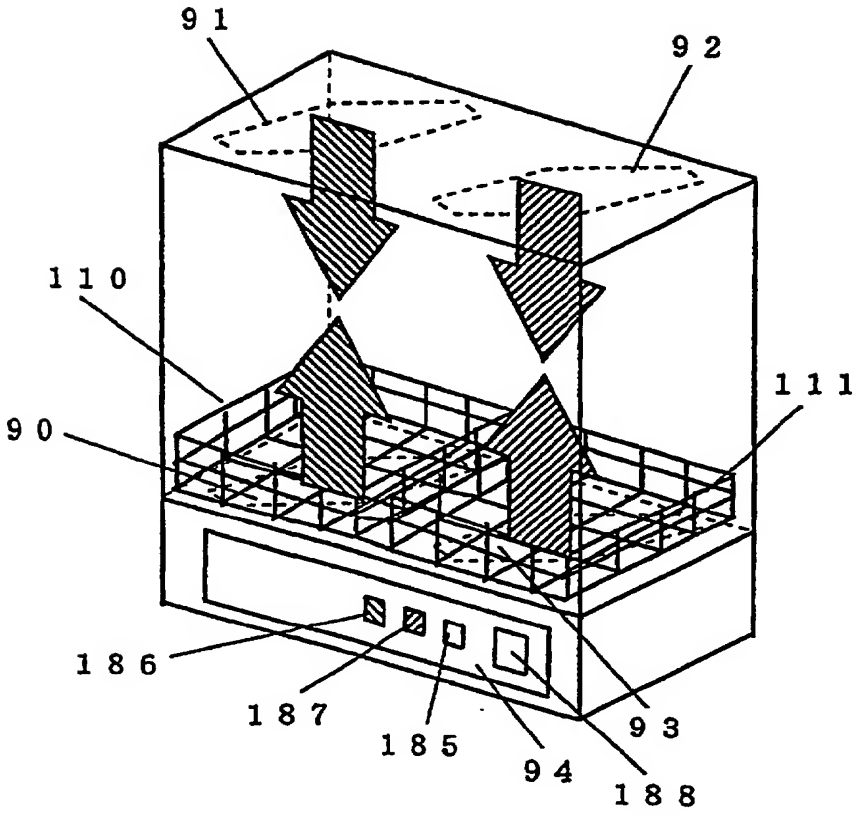


FIG. 28

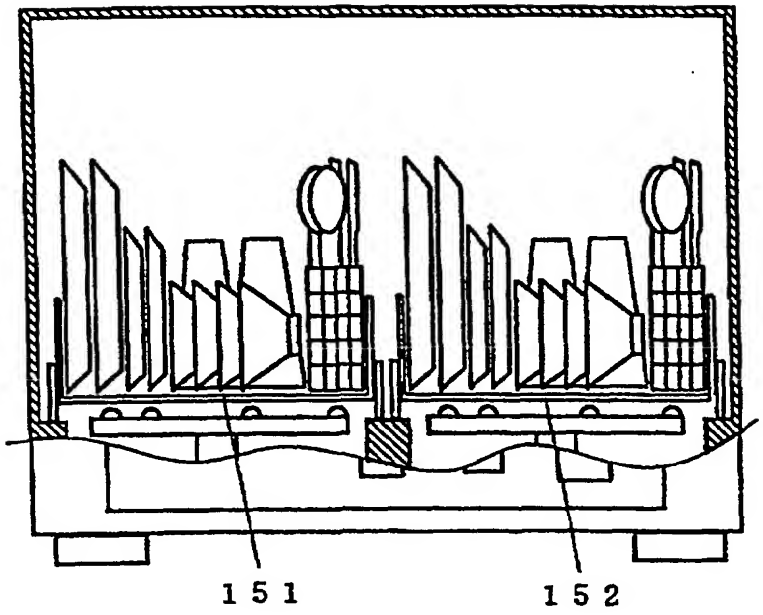


FIG. 29

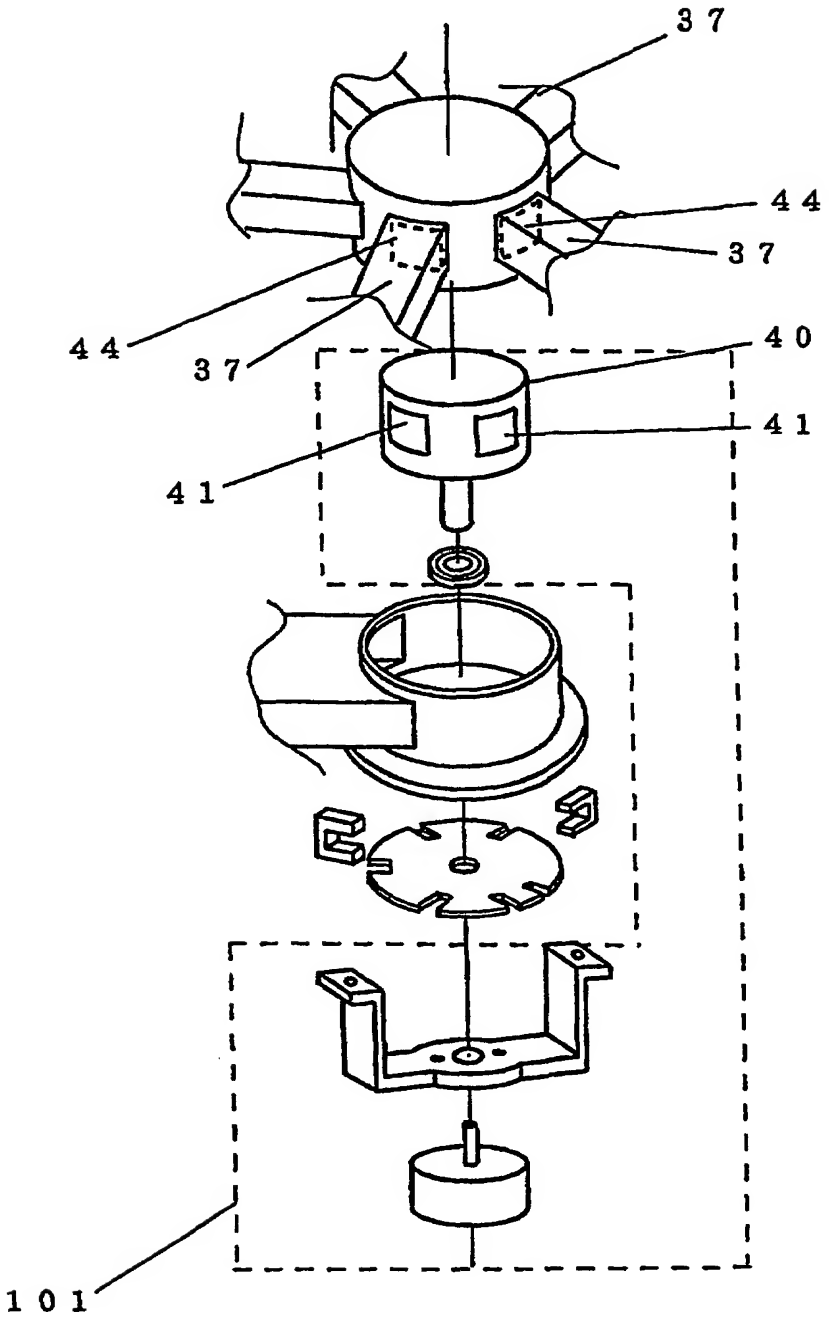


FIG. 30

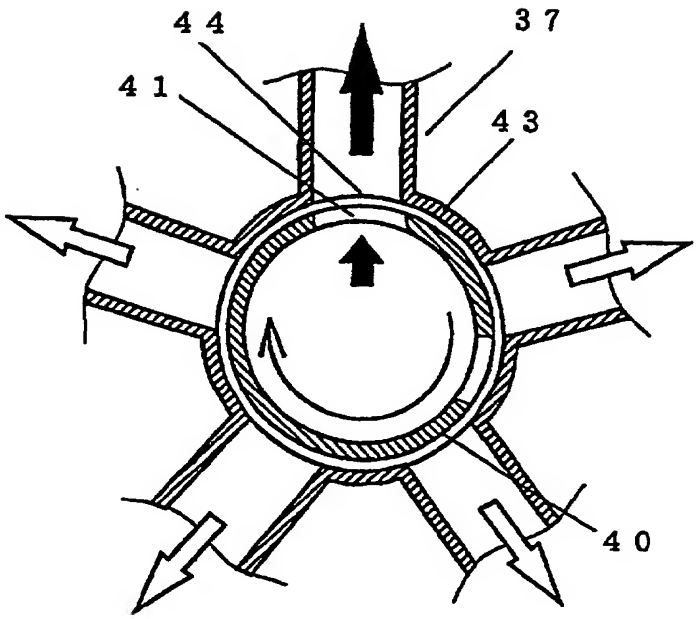


FIG. 31

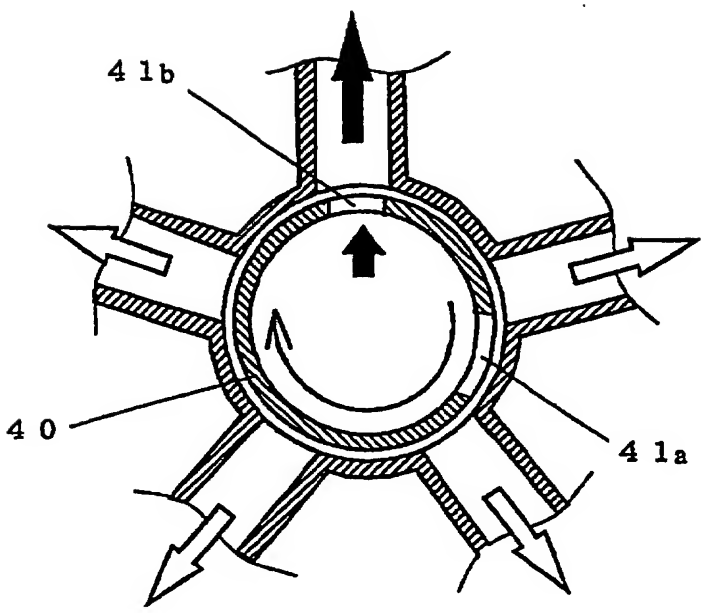


FIG. 32

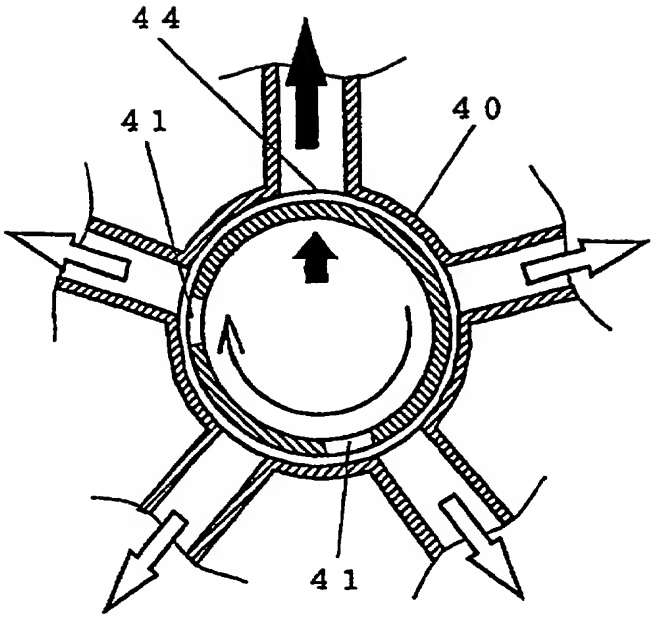


FIG. 33

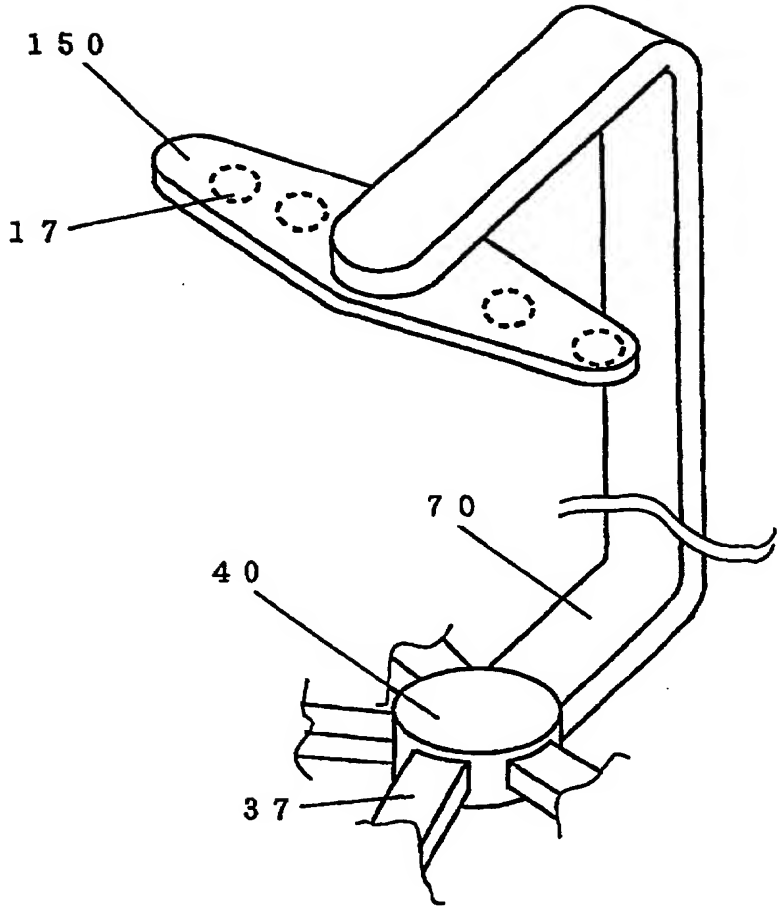


FIG. 34

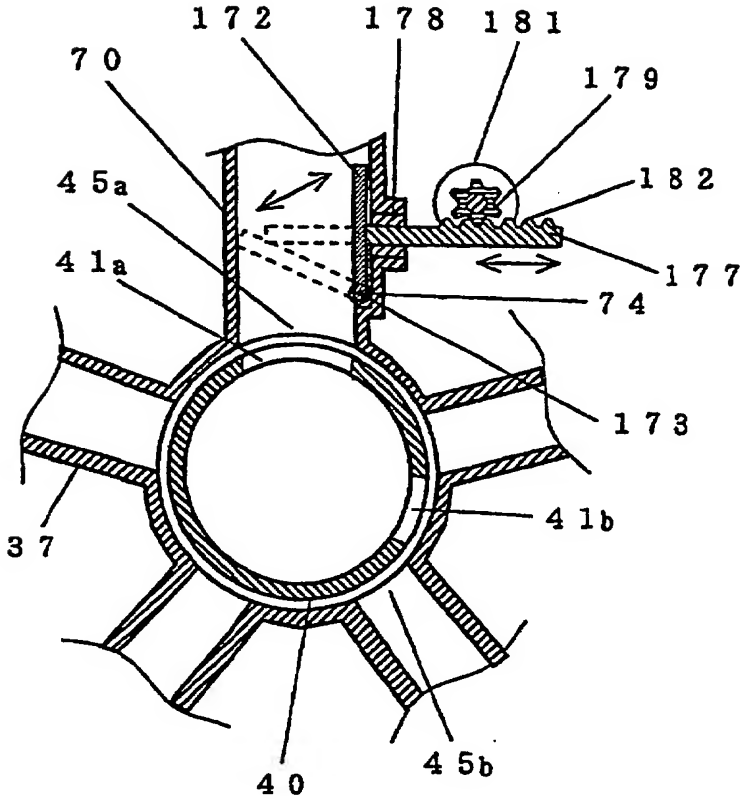


FIG. 35

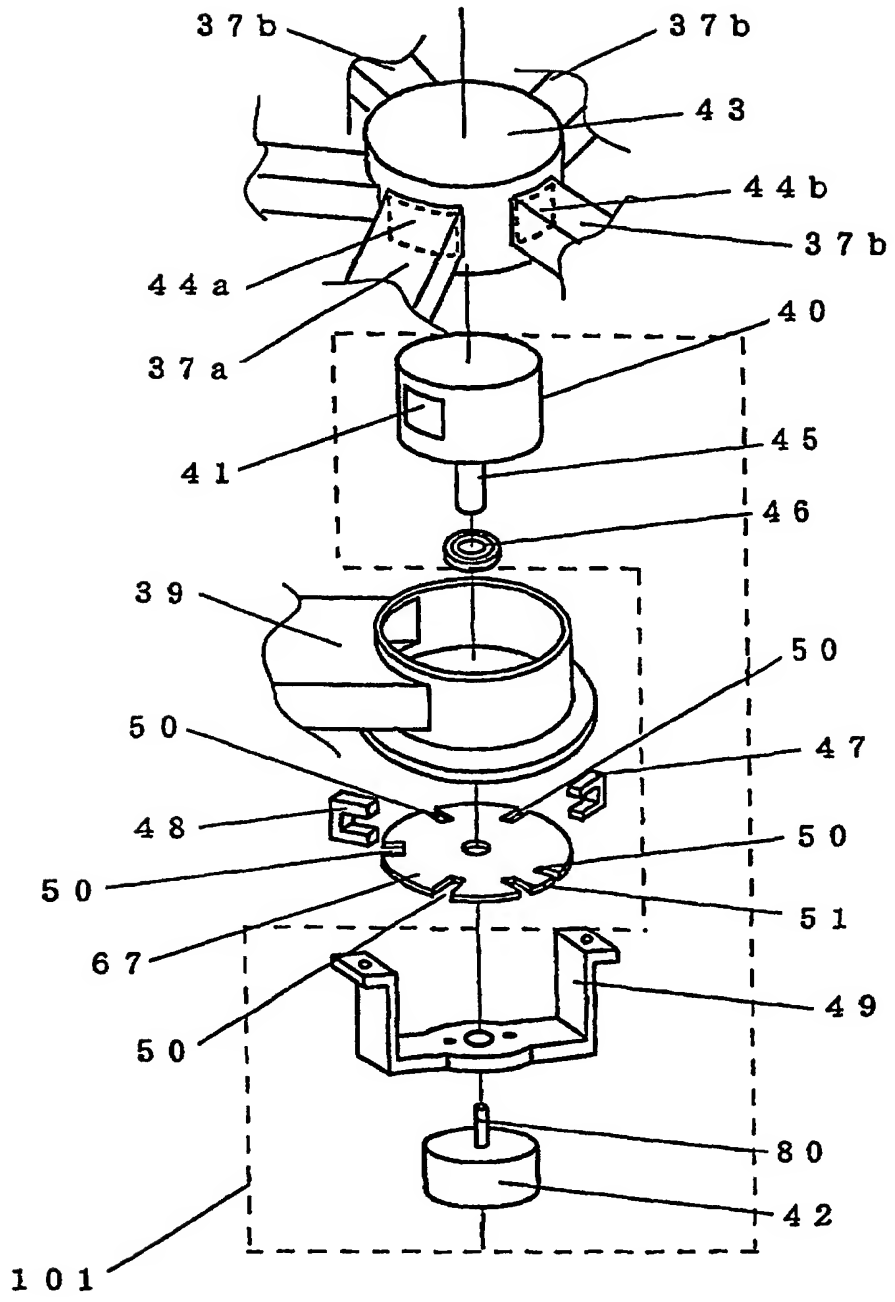
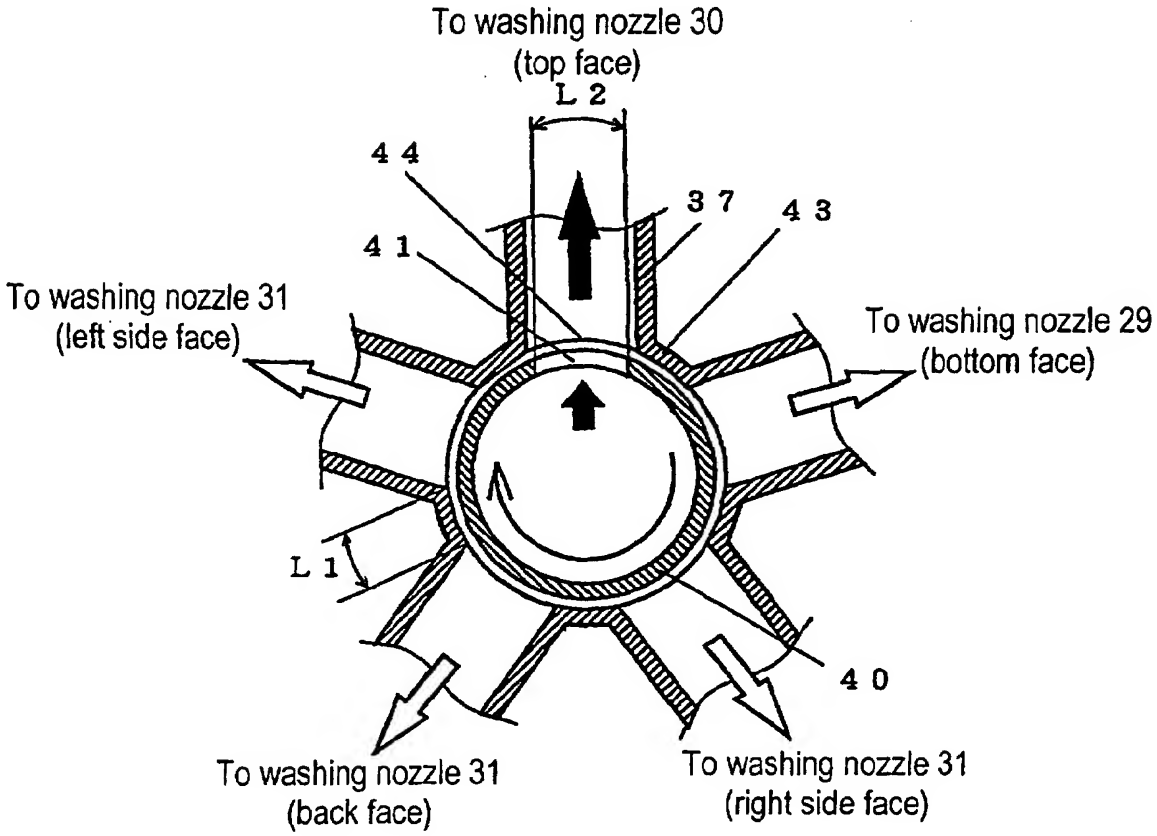

37b
37b
43
44b
37b
44a
37a
40
41
45
46
39
50
50
47
48
50
50
51
67
49
50
80
42
101

FIG. 36

(When discharge port is formed in cylindrical surface)



(When discharge port is formed in plane surface)

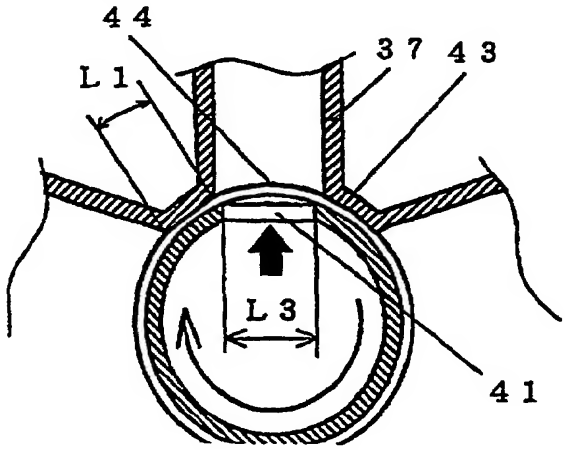


FIG. 37

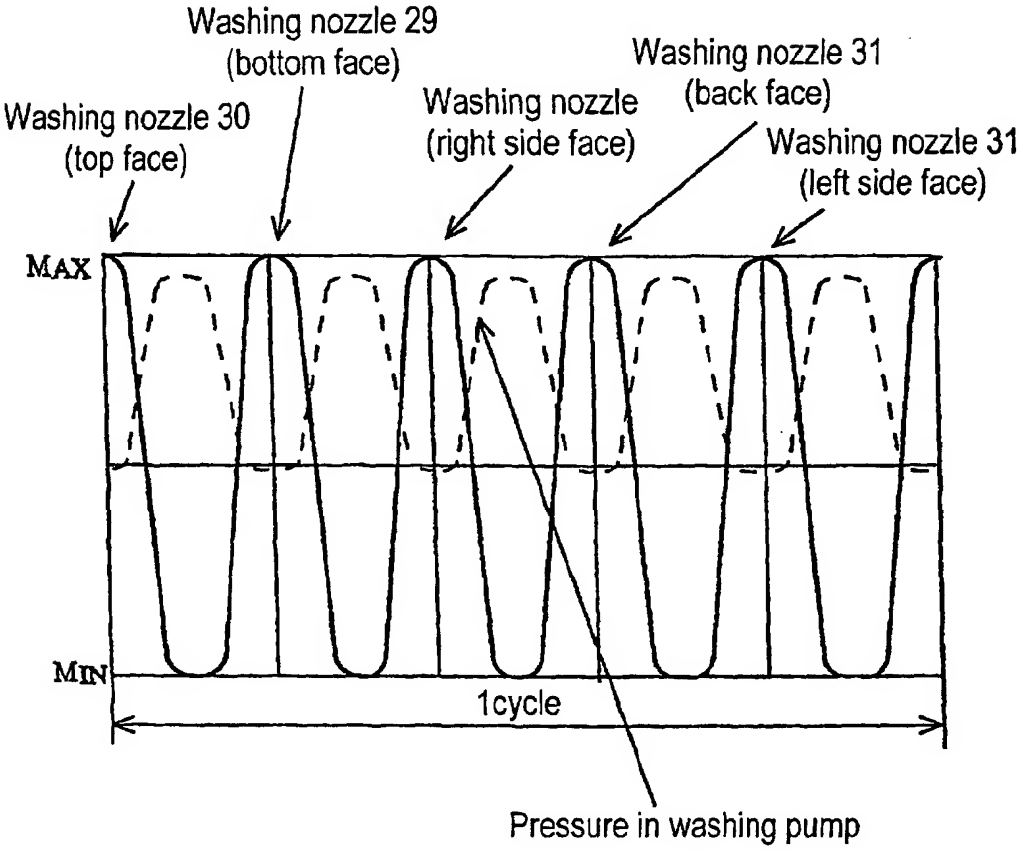

Washing nozzle 29
(bottom face)
Washing nozzle 31
(back face)
Washing nozzle 30
(top face)
Washing nozzle
(right side face)
Washing nozzle 31
(left side face)
MAX
MIN
1cycle
Pressure in washing pump

FIG. 38

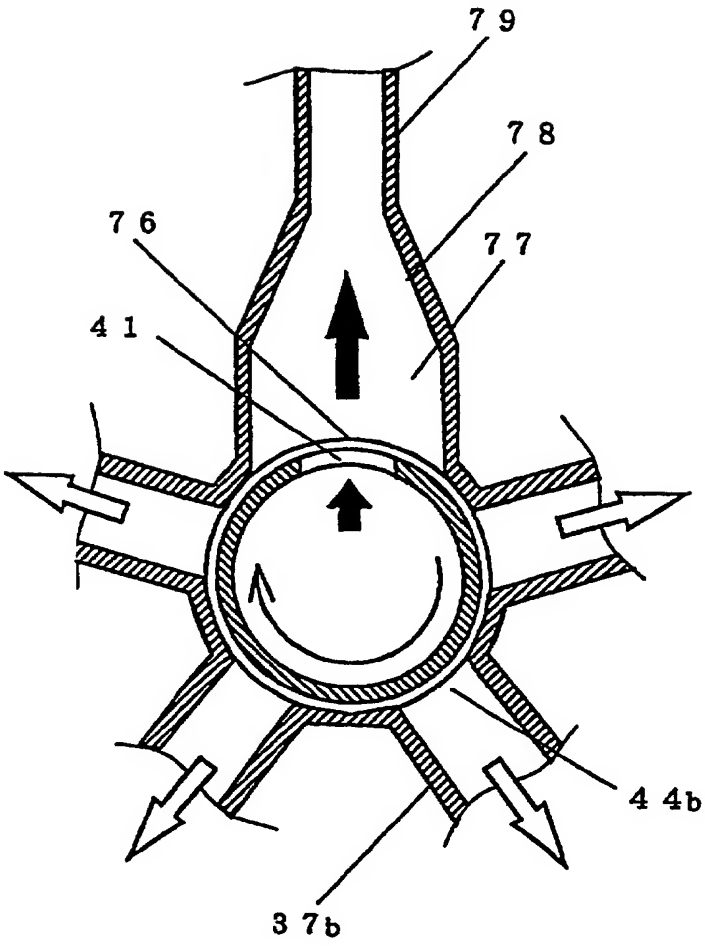


FIG. 39

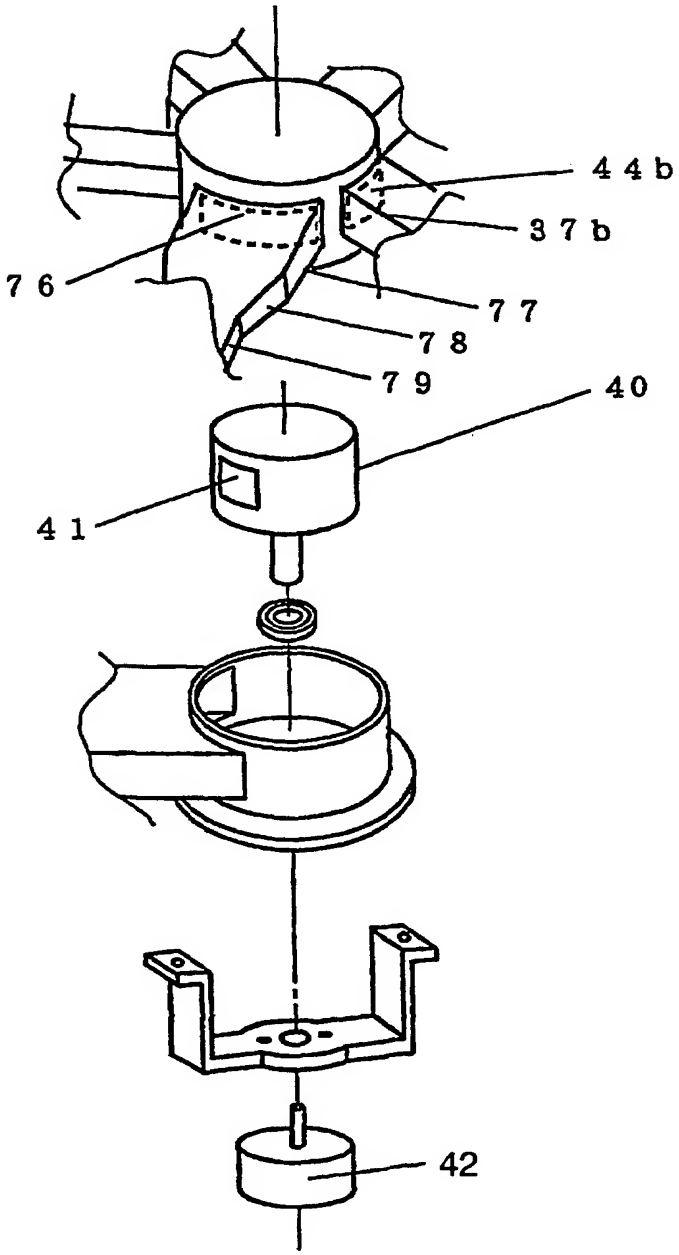


FIG. 40

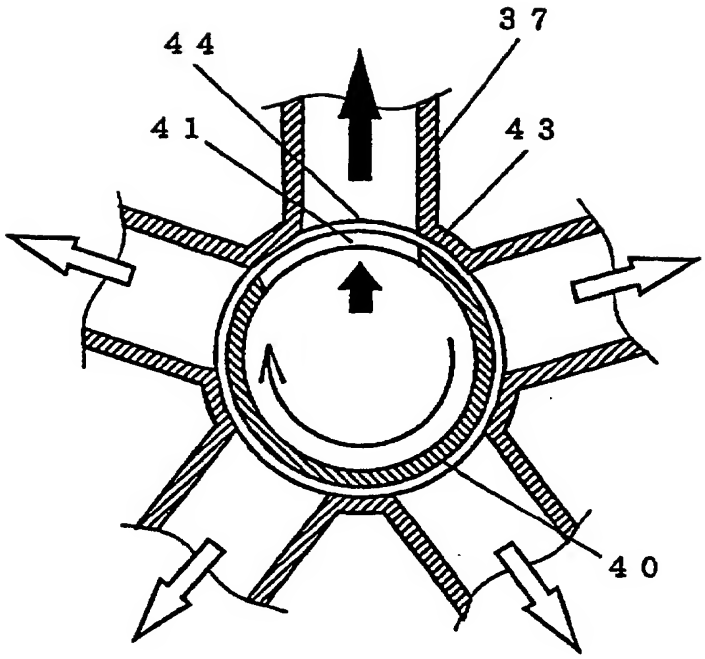


FIG. 41

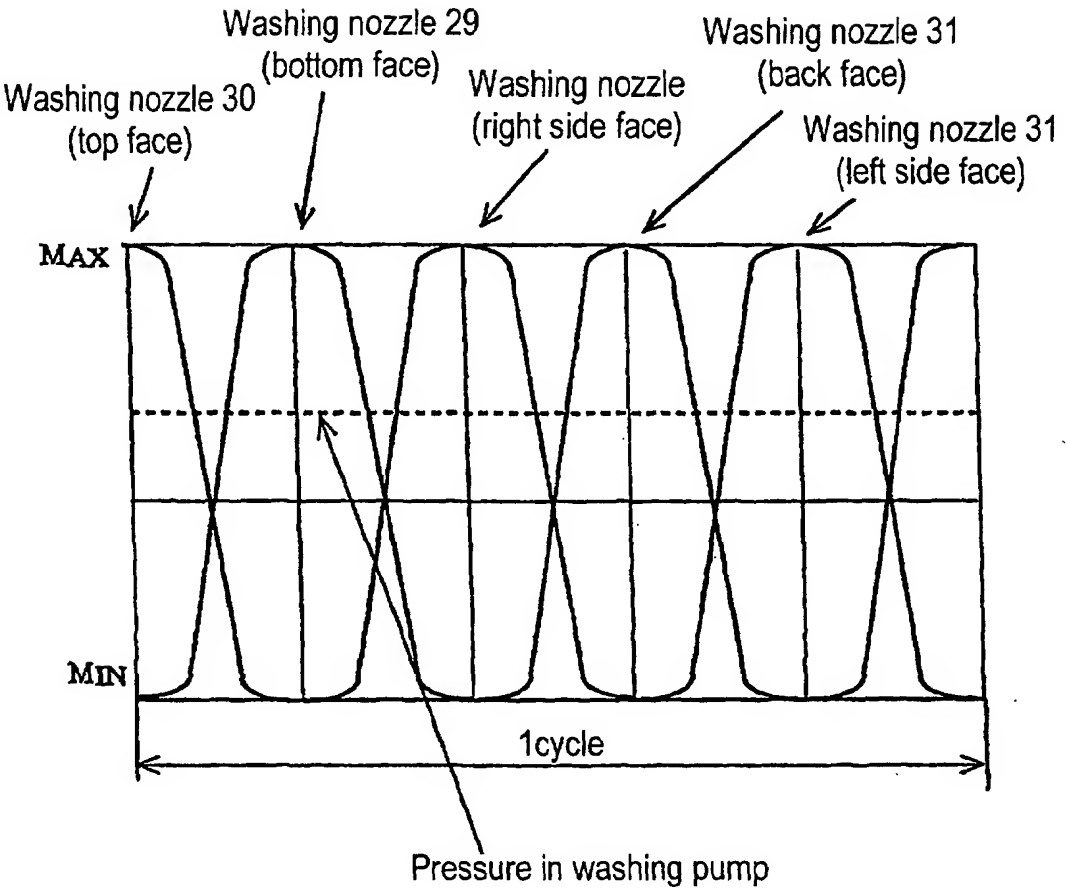

Washing nozzle 29
(bottom face)
Washing nozzle 31
(back face)
Washing nozzle 30
(top face)
Washing nozzle
(right side face)
Washing nozzle 31
(left side face)
MAX
MIN
1cycle
Pressure in washing pump

FIG. 42

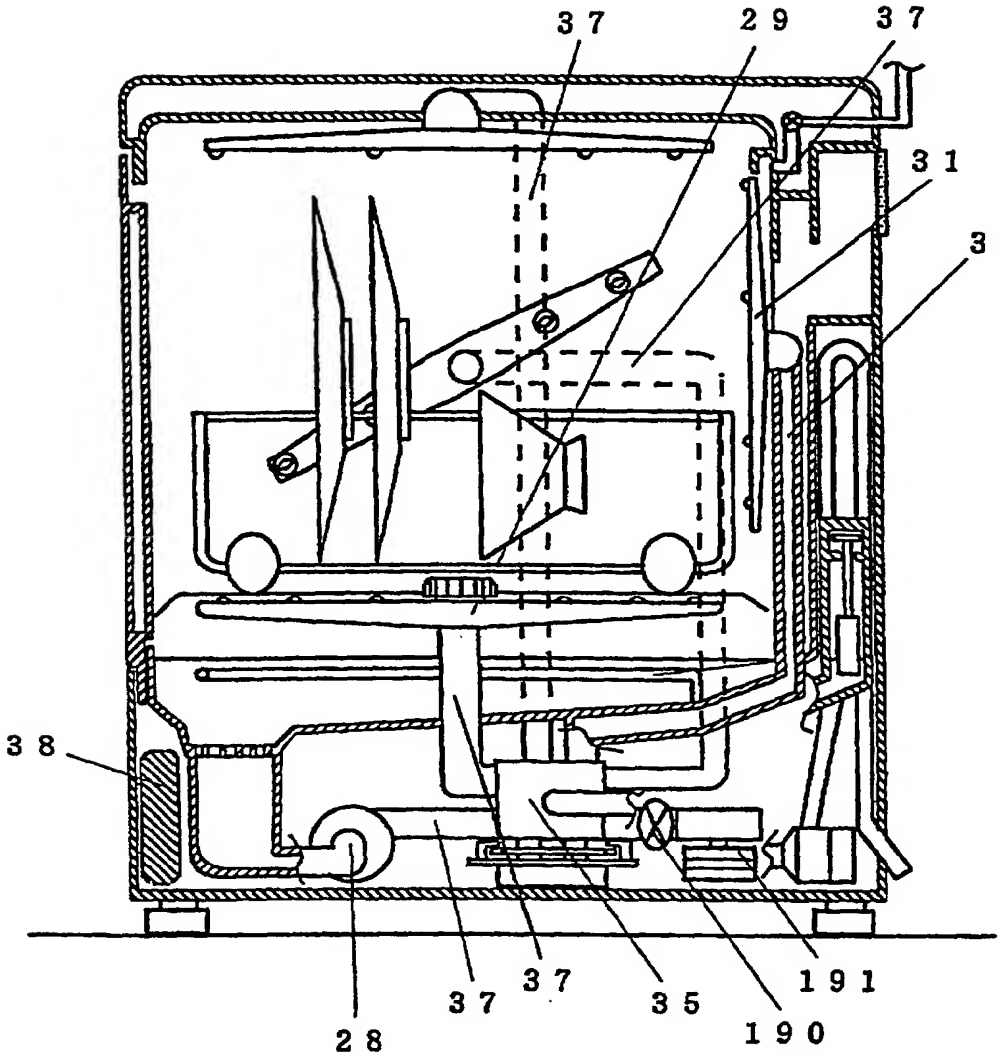
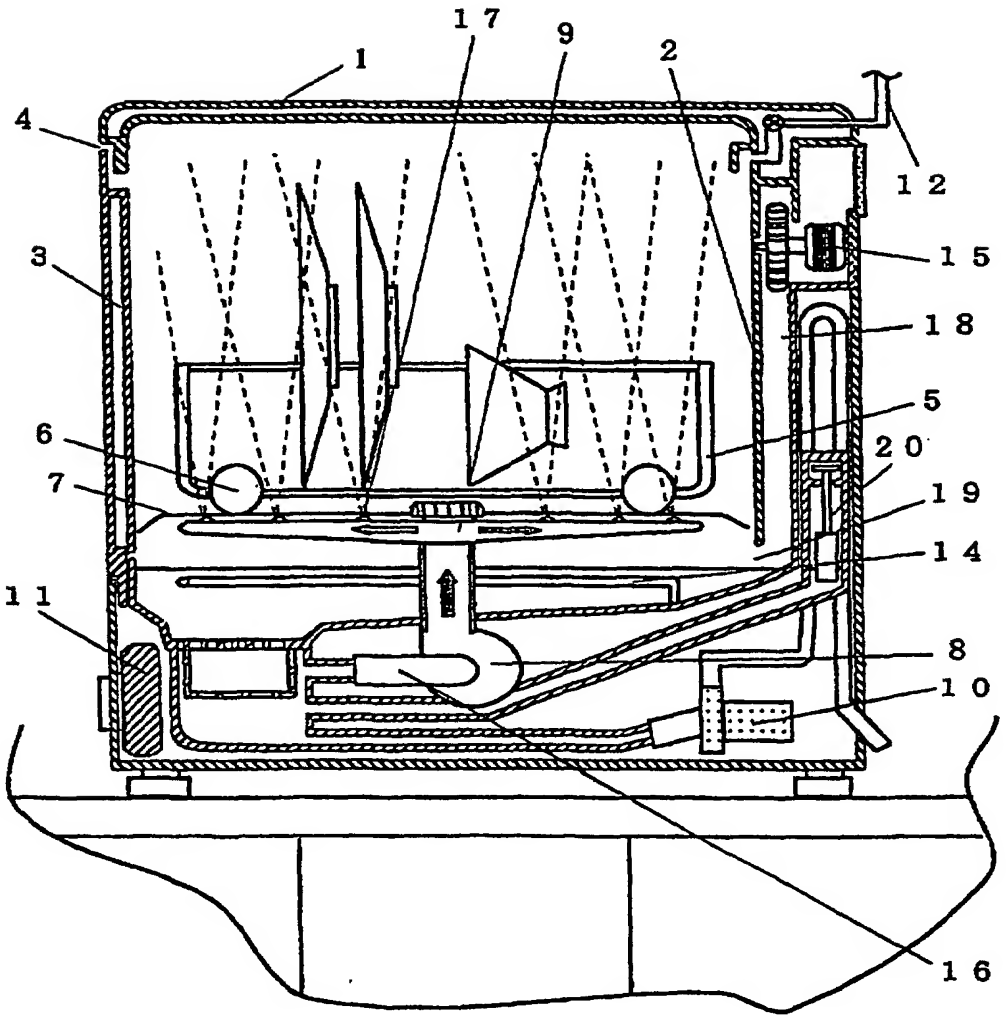


FIG. 43



Reference numerals in the drawings

17 Spray port
21 Body
22 Washing tub
23 Cover
25 Rack
28 Washing pump (washing water feeding means)
29 Washing nozzle (washing means)
30 Washing nozzle (washing means)
31 Washing nozzle (washing means)
32 Washing nozzle (washing means)
33 Drain pump
35 Water dividing apparatus
37 Washing/discharging passage
37a First feeding/discharging passage
37b Second feeding/discharging passage
38 Controller (controlling means, rotation angle detecting means)
39 Aqueduct (water dividing means)
40 Rotary water dividing unit (water dividing means)
41 Discharge port
41a Horizontally long type discharge port
41b Normal type discharge port
42 Driving motor (driving means, water dividing means, rotation angle detecting means)
43 Divided water output unit (water dividing means)
44 Divided water discharge port
44a First divided water discharge port
44b Second divided water discharge port
45 Rotating shaft
45a Horizontally long type divided water discharge port
45b Normal type divided water discharge port
46 Oil seal
47 Rotation angle detecting sensor (rotation angle detecting means)
48 Stationary position sensor for positioning (rotation angle detecting means, rotational position detecting means)
49 Frame for supporting driving motor

50 Slit for detecting rotation angle
51 Slit for detecting stationary position (rotational position detecting means)
52 Rotating nozzle (washing means)
53 Bar nozzle (washing means)
54 Rotating nozzle (washing means)
55 Fixed nozzle (washing means)
56 Rotating nozzle (washing means)
57 Rotating nozzle (washing means)
58 Fixed nozzle (washing means)
59 Fixed nozzle (washing means)
60 Fixed nozzle (washing means)
61 Rotating nozzle (washing means)
62 Rotating nozzle (washing means)
63 Rotating nozzle (washing means)
64 Rotating nozzle (washing means)
65 Rotating nozzle (washing means)
66 Rotating nozzle (washing means)
67 Rotation detecting disk (rotation angle detecting means, rotational position detecting means)
69 Draining passage (function means)
70 Washing/discharging passage
71 Driving shaft
72 Washing nozzle for upper rack
73 Washing nozzle for lower rack
74 Spring (passage varying means)
75 Divided water discharge port
76 First divided water discharge port
77 First feeding/discharging passage
78, 79 Passages
80 Driving shaft
81 Feed water port of the washing pump
82 Divided water discharge port
83, 89, 96, 102 Discharge ports
84 Rotary water dividing unit
85 Rotating shaft
86 Driving motor (driving means)

87 Aqueduct
88 Washing nozzle
90 Lower left washing nozzle
91 Upper left washing nozzle
92 Upper right washing nozzle
93 Lower right washing nozzle
94 Operating unit
95 Rotary water dividing unit
97 Divided water output unit
98 Divided water discharge port
101 Changeover unit (water dividing means)
103 Divided water discharge port for lower left washing nozzle
104 Divided water discharge port for upper left washing nozzle
105 Divided water discharge port for upper right washing nozzle
106 Divided water discharge port for lower right washing nozzle
110 Left rack
111 Right rack
120 Garbage collecting filter (foreign matter collecting means, function means)
121 Upper rack
122 Lower rack
124 Rotary water dividing unit
125 Driving motor (driving means)
126 Divided water output unit (passage varying means)
130 Rotating nozzle
131 Rotating nozzle
132 Rotating nozzle
150 Washing nozzle
151 Left rack
152 Right rack
172 Variable valve (passage varying means)
173 Turning shaft (passage varying means)
177 Rod (passage varying means)
178 Oil seal (passage varying means)
179 Pinion (passage varying means)
181 Rod driving motor (passage varying means)
182 Rack (passage varying means)

185 Operating switch
186 Left operating switch
187 Right operating switch
188 Washing course selecting switch
189 Washing nozzle for high flow rate
190 Open/close valve (blowing means)
191 Fan (blowing means)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/JP01/00922

A. CLASSIFICATION OF SUBJECT MATTER
Int.Cl[7] A47L15/42

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
Int.Cl[7] A47L15/42

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched
Jitsuyo Shinan Koho 1940-1996 Toroku Jitsuyo Shinan Koho 1994-2001
Kokai Jitsuyo Shinan Koho 1971-2001 Jitsuyo Shinan Toroku Koho 1996-2001

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP, 11-19019, A (Sanyo Electric Co., Ltd.), 26 January, 1999 (26.01.99) (Family: none)	1,2
Y	JP, 7-19412, Y (Daikin Industries, Ltd.), 10 May, 1995 (10.05.95) (Family: none)	1-44
Y	JP, 11-4797, A (Matsushita Electric Ind. Co., Ltd.), 12 January, 1999 (12.01.99) (Family: none)	10
Y	JP, 4-33633, A (Matsushita Electric Ind. Co., Ltd.), 05 February, 1992 (05.02.92) (Family: none)	24
Y	JP, 7-75617, A (Sanyo Electric Co., Ltd.), 20 March, 1995 (20.03.95) (Family: none)	29,30
Y	JP, 9-248270, A (Matsushita Electric Ind. Co., Ltd.), 22 September, 1997 (22.09.97) (Family: none)	38

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

* Special categories of cited documents:
"A" document defining the general state of the art which is not considered to be of particular relevance
"E" earlier document but published on or after the international filing date
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
"O" document referring to an oral disclosure, use, exhibition or other means
"P" document published prior to the international filing date but later than the priority date claimed
"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 April, 2001 (11.04.01)	24 April, 2001 (24.04.01)
Name and mailing address of the ISA/ Japanese Patent Office	Authorized officer
Facsimile No.	Telephone No.

Form PCT/ISA/210 (second sheet) (July 1992)